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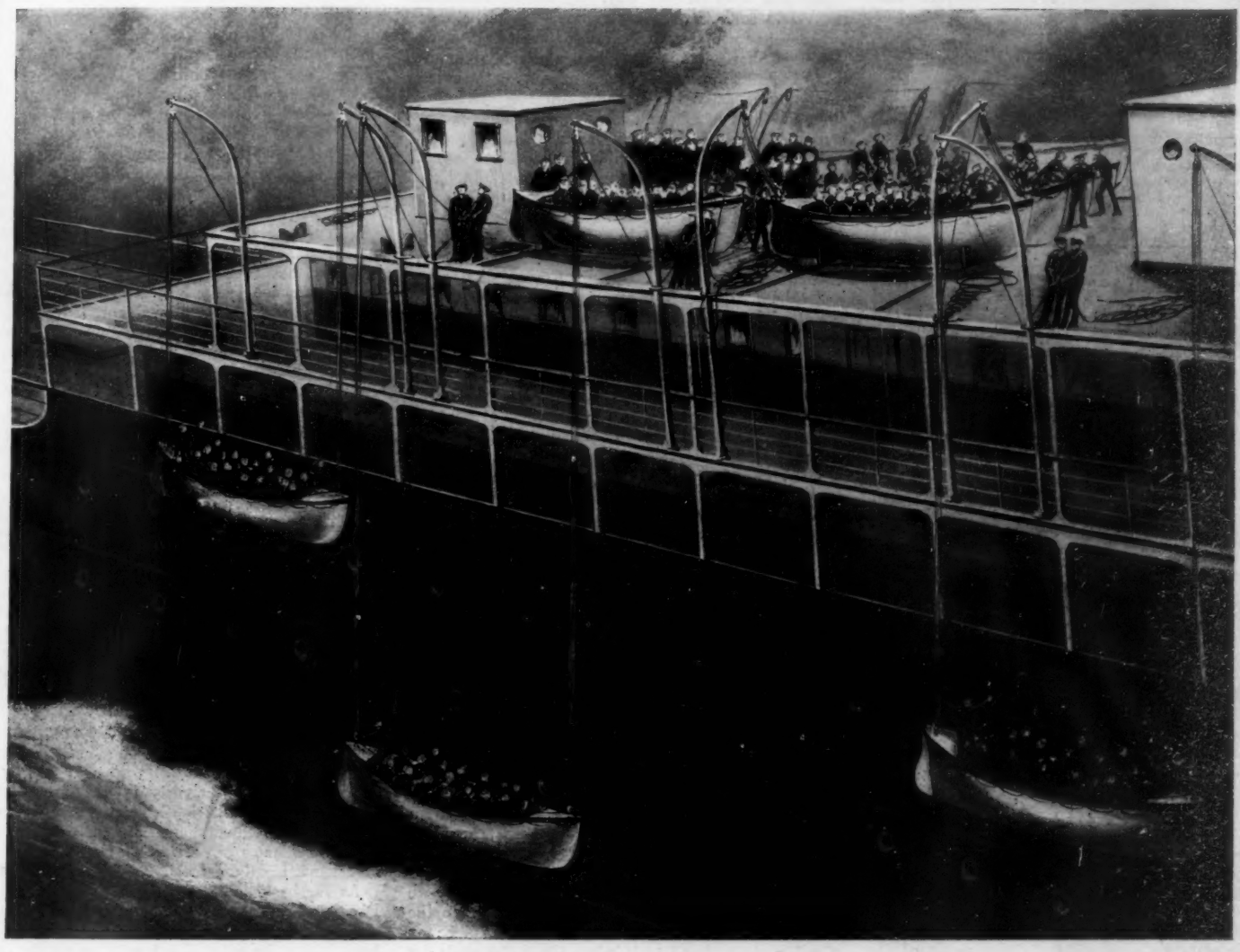
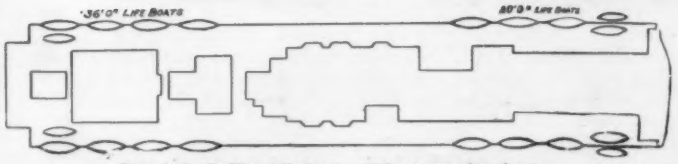
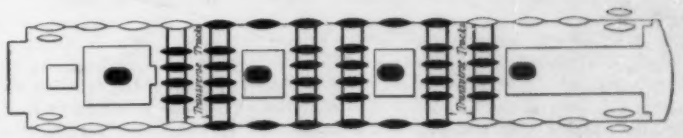


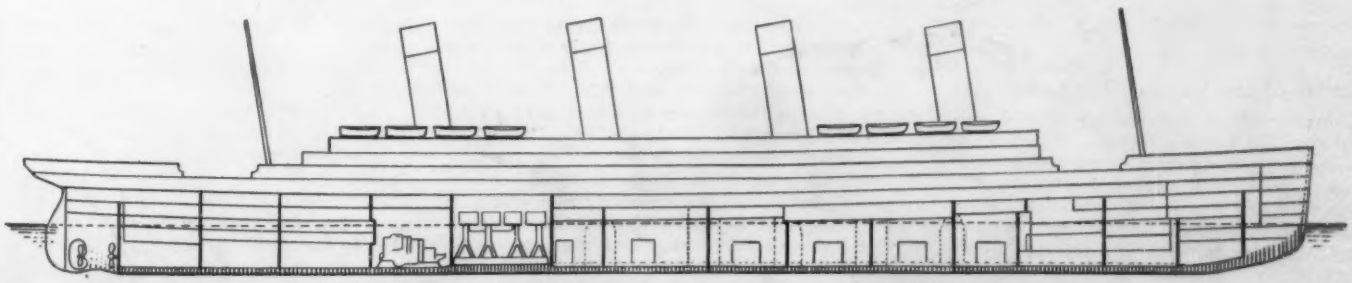
Suggestion for handling a full complement of lifeboats. The boats are loaded amidships and moved on tracks to the davits.



Boat deck of "Titanic" showing 20 boats carrying about 1000 passengers.



Plan of boat deck showing suggested accommodations for 56 boats carrying about 3100 passengers



Longitudinal section of "Titanic" showing in heavy lines the transverse bulkheads.

Suggested plan by which sufficient boats could be carried to accommodate the ship's full complement. Boats carried amidship on tracks on which they can be moved to either side of the ship.

LOSS OF THE WHITE STAR LINER "TITANIC"—[See page 380].

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Light Out of a Dark Tragedy

OUT of the necessarily confused and contradictory stories of the "Titanic" disaster, told by the survivors, there has shone, conspicuously, one reassuring fact, which has shed a softening light upon the unspeakable horror of the disaster.

Supreme among the master motives of this complicated human nature of ours are the love of life and the instinct to preserve it at whatever cost. True it is that under certain conditions of iron discipline or the contagious passion of the multitude, men have seemed to hold life less dear —and so the roll of recorded heroism has grown with the passing years.

When the side of the "Titanic" was torn asunder, the rapid settling of the ship must soon have foretold her doom to every thinking man aboard; and early in the development of the disaster the terrifying fact was known that two out of every three of that ship's complement must go down in that ice-covered sea.

Yet in all the narratives of those final hours of agony there is practically unanimous testimony to the noble spirit of chivalry which prevailed. With scarcely an exception the men stood aside and surrendered the one chance of life for women and children, until the safety of every one of these had been assured. Then, with that calm resignation in the face of certain death which is the mark of the highest courage, and to the music of the band (to whose eternal honor be it recorded) the majority awaited the final plunge, or flung themselves in a last vain hope into the dark waters.

Let the pessimist who laments the debasing effects of our modern civilization take note of this—the supreme triumph of the man in us over the brute. The blow which proved the "Titanic," the supreme exhibit of our boasted skill and prowess, to be after all but a fragile shell, served to demonstrate the eternal strength and the eternal growth of those sublime qualities of heart and mind, which, after all, are the true values and highest glory of our human life.

Lessons of the "Titanic" Disaster

ON Sunday, April 14th, the largest and supposedly the safest steamship afloat, while steaming on her proper course, on a clear, starlit night, struck an iceberg and within a few hours sank, carrying down with her over sixteen hundred souls.

The technical lessons taught by this prodigious disaster are three: First, that the naval architect has not yet learned how to make an absolutely non-sinkable ship, and, that, probably, he never will. Second, that if every ship is sinkable, it should carry at least a sufficient number of lifeboats to take care of every person on board until other ships, summoned by wireless, can reach the scene of a disaster. Third, that the transatlantic sailing route for passenger steamships should be shifted so far south as to be entirely beyond the track of floating icebergs.

The loss of the "Titanic" has brought home to the public at large the fact (always understood by the naval architect), that in spite of the improvements in ship design and construction, there is not a vessel afloat which is unsinkable by one or other of the accidents to which ocean travel is liable. And this is not to say that a great advance toward the unsinkable ship has not been made. The double bottom, the water-tight compartment, bulkhead subdivision, the powerful steam pump, and, above all, the vast size of the modern steamship, have conspired to render such a ship as the "Titanic" proof against any but the most severe trial. A collision with another ship which would have quickly sunk the 7,000-ton ship of the early eighties, would have relatively little effect upon the stability of the 45,000-ton ship of our day. A sailing schooner sufficed to send the swift "Oregon" to the bottom; but the blow which sunk the crack liner of that time would not have endangered for a moment the flotation of the "Titanic." In the presence of the overwhelming disaster to this ship we must not lose sight of what has been done upon the hull of the modern liner to make ocean travel safe. We very much doubt if any possible accident of wind, weather, or collision with another ship, could have sunk the "Titanic." In meeting the fatal iceberg in mid-Atlantic she encountered the one form of accident which could surely wreck her, namely, that of running ashore or, what is tantamount in its effects, collision with an iceberg of magnitude.

If, then, the modern ocean liner is not unsinkable, dictates of common prudence and humanity demand that it should carry a sufficient number of lifeboats to accommodate every soul on board. The regulations of the United States and the German governments call for boats to carry, in the large liners, two-thirds of the passengers and crew; but no government demands enough boats to carry the complement of an absolutely full ship. In Great Britain the question of lifeboat accommodation is determined by the Board of Trade, and under their regulations a ship like the "Titanic" is required to carry lifeboats sufficient for *only about one-third of the ship's complement of passengers and crew*. Under an international agreement our government accepts the certificate of inspection of foreign countries; and if the Board of Supervising Inspectors find that the foreign ship carries the number of boats called for by the certificate, she is permitted to sail.

Under the laws governing American ships a ship of a given size must carry boats of a certain total cubical capacity. Under the table given in the Regulations of the Board of Supervising Inspectors we find that, had the "Titanic" carried the American flag, she would have had to provide 24,120 cubic feet of space in her lifeboats, which, at 10 cubic feet per passenger, would have afforded accommodation for 2,412 passengers and crew. As it was, the maximum provision in the lifeboats that the "Titanic" carried was about one thousand!

Now, as regards the conditions on this ship, we can simply say that they were an invitation to the very kind of ghastly horror which took place on Sunday night, April 14th, when the 1,600 souls for whom no lifeboats had been provided went to an inevitable and altogether unnecessary death.

The Department of Commerce and Labor, in which the Steamboat Inspection Service is included, will be remiss in the duties with which it is charged, if it does not become the moving spirit in an effort to change the treaties with foreign governments, so that our government can compel every ocean-going steamer which visits our ports to carry sufficient lifeboats of first-class construction to accommodate every soul on board.

Finally, we take it that the future steamship routes must be moved so far south during the spring and summer months as to be absolutely clear of the awful menace of the iceberg.

In the presence of this stupefying disaster, we enter a plea for the exercise by Congress of a calm and judicial spirit in all legislative action which may be taken. Evidently the matter is one for joint international action. The Hague Tribunal has been suggested, but the subject scarcely comes within its scope. A special international commission, including the leading builders, ship owners and insurance agents of the world, would be better qualified for the task.

Did the "Titanic" Sink to the Bottom?

NUMEROUS inquiries have reached the office of the SCIENTIFIC AMERICAN in which it is asked: "Did the 'Titanic' sink to the bottom of the ocean, or was she held suspended at a depth of a few hundred feet?" There is only one reply: The "Titanic" is at the bottom.

Such questions are based upon the erroneous supposition that the density of the water at the bottom of the sea is far greater than that at the surface. Density is here confused with pressure. The pressure increases enormously as we descend, amounting to considerably over 6,000 pounds per square foot at a depth of 100 feet. Divers sometimes work at depths of as much as 150 feet, where the pressure is half again as much, 9,363.75 pounds, to be exact. When provided with special armored diving suits, divers have operated at considerably greater depths; but nothing approaching the depth at which the "Titanic" now lies. This depth is given at 2,000 fathoms, which is considerably over two miles, and the pressure amounts to three-quarters of a million pounds per square foot.

It is only natural to suppose that under such pressures the density of the water would be increased; but laboratory experiments have shown that it is almost impossible to compress water. Indeed, for a long time it was thought that water was absolutely incompressible; but by the use of more sensitive measuring instruments it has been found that at a depth of a mile the density of sea water is only 1/130 greater than at the surface. However, for all practical purposes we may consider that a given volume of water is not materially reducible in dimensions by pressure.

With this clearly in mind, it is very evident that an object that would not float at the surface of the sea could not float at any intermediate point, but must surely sink to the bottom; for it could not displace a greater weight of water at the bottom than at the top, even though the water in the first case was under much higher pressure. As a matter of fact, any air-filled chambers or compressible matter in the vessel would be crushed in by the enormous pressure of the water, so that the displacement of the wreck would be growing less as it went down and it would be falling through the water at a corresponding acceleration. We must also remember that even steel is more compressible than water, and consequently a solid block of this material would actually weigh more at the bottom of the sea than at the top.

The Passing of Pacinotti

THE ways of that which we call Fate are indeed marvelous, nor are the hazards of Fame any less mysterious. At a moment when an admiring world echoes with the achievements of one Italian electrical inventor, there passes from the earth in deepest obscurity another Italian to whom the arts and sciences are also under obligation; and the contrast is dramatic. Incidentally, it may be noted that the country of Volta by some curious process of heredity or continuance always holds her own in the industry to which Volta gave birth, but only the student knows that alongside the gleaming name of Marconi may also be set those of Pacinotti and Ferraris.

As far back as 1864 the gentle Italian physicist, Pacinotti, introduced timidly to public notice a small electro-magnetic machine, with toothed ring armature, which, he pointed out with prophetic instinct, was available both as a motor and as a generator. And then nothing happened! But when the celebrated Gramme dynamo with its ring armature arrested universal attention, seven years later, the unobtrusive professor dug up his treatise and his machine and showed that beyond a doubt he was entitled to the credit of the discovery; although he lacked the essential driving power to turn it into a device useful to mankind.

There perhaps lies the lesson of his career. We need physical discoveries and revere those who seek the truth for its own sake. But mankind with keen instinct saves its warmest acclaim for those who also make these discoveries of some avail in adding to the length of life, its joy, its possibilities, its conveniences.

Had not the hustling Belgian, Gramme, come along with his famous dynamo and his sanguine French backers, Pacinotti would have let his model slumber forever in museums and cabinets, just where many things the world is waiting for linger now. The fact that Y. Pacinotti so little realized what he had done and what his really great inventive ability meant, is shown by the curious fact that the work and studies of his later years were devoted to vine culture. If he did anything significant there the records of our time fail to note it; but meanwhile the glorious torrent of electrical invention has swept on, so fast and so far that to many people even this bold recognition of the amiable doctor's genius may seem a bit superfluous.

Engineering

Progress on the Panama Canal.—On March 23rd over 82 per cent of the concrete for the locks at Panama had been laid. On that date 92 per cent of the concrete at Gatun locks was in place, 98 per cent of that in the lock at Pedro Miguel, and over 55 per cent of the concrete for the locks at Miraflores. Concreting in the Spillway of Gatun dam was over 85 per cent completed.

Iron Ore in the Lake Superior Region.—In his recent testimony before the House Steel Investigating Committee, Joseph Sellwood of Duluth, an authority on the subject of ores, stated that in the Lake Superior region 1,400,000,000 tons of ore are available. Of this amount about 550,000,000 tons are controlled by the United States Steel Corporation. It was further testified by another witness that about 400,000,000 tons of available ore are owned by the Tennessee Coal and Iron Company.

Annual Cost of Panama Canal.—According to the estimates of Prof. Emory C. Johnson before the Senate Committee on Inter-oceanic Canals, the total annual cost of the Panama canal will be $31,000,000. Of this total $11,500,000 will represent interest on the money invested in construction; $15,000,000 will be the cost for the defense of the canal; and $4,500,000 will represent the cost of repairs and operation. As against this he does not expect the revenue from tolls to exceed $1,000,000 for the first year.

Oil Engine Equipments for Deep Sea Ships.—There are at present some fifteen ships under construction in European yards for deep sea service, which will be driven by Diesel engines. The ships vary in size and power from 10,800 tons with 3,500 horse-power to 2,200 tons with 1,100 horse-power. The most powerful engine is a 4-cycle, single-acting installation containing twenty-four 24.8-inch cylinders, the total horse-power being 6,000. These engines will be installed in a cargo and passenger vessel of 8,500 tons.

Destroyer Equipped with Super-heaters.—The destroyer "Attack," one of a special class equipped with super-heaters, was recently built by Yarrow for the British government. On her recent speed trial on the Clyde she attained a mean speed of 30.6 knots during a continuous run of eight hours, exceeding the contract speed of 28 knots by 2.6 knots. The vessel, 240 feet long by 25 feet 7 inches beam, is driven by Brown-Curtis twin-screw turbines, steam being supplied by three Yarrow water-tube boilers equipped with superheating and feed-heating appliances.

San Francisco to New York in Three Days and a Half.—The acceleration of transcontinental railway travel during the past two years has been made so quietly, that not many people are aware that the time from ocean to ocean has been reduced to less than three and a half days. The fact was recently brought into prominence by daily press notices of a trip made by an Australian passenger who left San Francisco at 10:40 P. M., March 2nd, and reached New York March 6th in time to catch the steamship sailing at noon the same day for Europe, the total time from San Francisco to New York being three days eleven hours.

A 54,000-ton Ship.—The North German Lloyd Steamship Company, it is announced, has let a contract for the construction of a 54,000-ton transatlantic liner. This marks a great advance even upon the huge ships which have made their appearance during the past five years. The largest of the North German Lloyd existing fleet is the "George Washington" of 27,000 tons. The next largest vessels are the "Mauretania" and "Lusitania," of 32,000 tons, the "Olympic" of 45,000 tons, the "Imperator" of the Hamburg-American Line, now building, of 50,000 tons. The new North German Lloyd ship is of just twice the tonnage of the "George Washington."

Trespassers and Railroad Deaths.—President Miller of the Burlington Railroad recently wrote to the governors of the States through which his road runs showing that 51 per cent of all the railroad fatalities happen to trespassers. Out of the total number of 10,396 killed in the United States for the year ending June 30th, 1911, 5,284 were trespassers, an average of more than fourteen per day. The number of dead from railroad accidents in the last ten years is 51,083, of which only 4,340 were passengers. During this period there was not a single year in which the total number of trespassers did not exceed the total number of passengers killed during the entire decade.

The Demand for Free Ships.—The Chamber of Commerce of this city has passed a resolution advocating free ships; that is to say, the Chamber would have the laws changed to permit American shipping interests to buy vessels in the cheapest markets of the world and have them admitted to American register. It was argued that Americans own one million tons of foreign-built tonnage, which, if the laws were changed, would come under the United States flag, thus constituting a good beginning of an American merchant marine.

Electricity

Electricity in Rain.—It is an observed fact that rain may carry an electric charge, and this charge may be either positive or negative. M. A. Baldit has made various researches in France, and has found that in 11,336 readings taken with an electrometer at intervals of 15 seconds, 8,400 showed that the rain was charged positively and 2,936 gave negative charges. For a unit volume of water, negatively-charged rain is seen to carry a stronger charge, and this is true for storms or for ordinary rainfall. On the other hand, it is found that for ordinary rain the positive charges are of more frequent occurrence. His results as to the predominance of positive charges are in accord with the researches made by G. Simpson in India and K. Kähler in Germany.

Pupin Loading System in Submarine Telephony.—The success of the first Anglo-French loaded telephone cable, laid early last year, has caused the British Post Office to lay a four-conductor cable of this type between England and Belgium. Among improvements incorporated in the new cable are the use of a smaller weight of dielectric per knot and the "phantoming" of the two metallic circuits so as to obtain a third commercial talking circuit by inserting an additional series of loading coils. In the manufacture of this cable considerable ingenuity was exercised in forming the armor at the successive coils so as to maintain the latter in watertight condition under the tensile stress of laying the cable. Tests after laying showed that the new cable, which is about 48 nautical miles long, has speaking properties equivalent to 7.5 miles of "standard" cable. It follows that it should be possible to lay a loaded cable of this type, giving commercial telephone service, to a total of 200 nautical miles.

Cost of Electricity for Different Typical Installations.—The retail prices of electrical energy in the largest cities in this country revealed by the recent research of a committee of the National Electric Light Association show the relation of cost per kilowatt-hour to character of consumer's installation. The average retail prices for electricity were obtained by selecting at random actual bills covering a period of one year for twelve typical installations; and the digested figures show a curve of average cost sloping steadily downward from a little less than 10 cents per kilowatt-hour for a six-room apartment, through a church, an office, a ten-room dwelling, a retail store, a printing shop (light), a manufacturing plant (light), a printing shop (power), a saloon, an all-night lunch room, a drug store, to 4.4 cents per kilowatt-hour for a manufacturing plant (power). An inspection of the trend of this curve tends to obviate hasty comparisons (liable to lead to unjust conclusions) in discussion of the rate charged by a particular electric light company.

Detecting Thunder Storms.—With instruments installed at the Lyons observatory, M. Flajolet has been able to note atmospheric electrical disturbances when these were at a considerable distance, and in some cases storms were observed when they were as much as 300 miles off. He used a modified wireless telegraphy outfit, and found that an electrolytic detector was not good for this kind of work, as it needs to be left constantly on the circuit and hence gets out of order. A mineral detector made with sulphide of lead and fine copper points answered very well, however, and it is as sensitive as the other type. A relay could be used to take the storm signals, but when the atmospheric effect was far off the current was much weaker and had to be received by a sensitive galvanometer with photographic registering. In this way he could observe the effects of storms at great distances and which would take at least 24 hours to arrive.

Reliability of Single-phase Electric Railways.—The single-phase electric railway operates by alternating current stepped down to working voltage, for the alternating current car motors, by static transformers, and therefore requires little or no sub-station attendance such as forms an unavoidable expense of the operation of direct current railways in isolated communities distant from the power house, with their necessary equipment of rotary converters. The impression that the single-phase system is suitable only for heavy railway work, such as trunk lines, and heavy freight service is proved erroneous in the case of a railway of this type on the north shore of Long Island, N. Y. This road is an example of a small isolated line operated in a thinly settled community where a railway system of any kind would ordinarily be considered out of the question because of the investment required. This company does not generate its own power, but buys 11,000-volt energy from a power station 27 miles distant, stepping this energy down to a trolley voltage of 2,200. The road operates one sweeper in conjunction with its seven cars, and claims the distinction of being the only line in its vicinity that has not lost a single schedule trip during the snow storms of the past winter

Science

New Name of a German City.—Existing maps of Germany stand in need of several corrections on account of recent changes in the names of German towns. The latest of these changes substitutes "Neukölln" for "Rixdorf" as the name of one of the largest suburbs of Berlin (population 236,000).

Compulsory Wireless in Uruguay.—After May 1st, 1912, all vessels carrying passengers to or from the ports of Uruguay will be required by law to be equipped with wireless telegraphic apparatus, which must be kept in good working order. The instruments on river steamers must have a radius of 62 miles; those on ocean vessels, 248½ miles.

Exploration of Nova Zembla.—Three Russian exploring expeditions visited Nova Zembla during the summer of 1911, chiefly with a view to discovering mineral deposits. One party made a complete circumnavigation of the southern island in a motor-boat, landed at many points, and carried out geological investigations. On the south coast were found the remains of a Russian settlement, the inhabitants of which probably succumbed to scurvy a century or more ago. Some traces of copper and naphtha were discovered.

Pan-American Scientific Congresses.—Three Latin-American scientific congresses have been held in South America. The fourth of the series, by including delegates from the United States, became the First Pan-American Scientific Congress, and was held at Santiago, Chile, December 25th, 1908 to January 5th, 1909. The report of the United States delegation has been published as Senate Document 64, 61st Congress, first session. The Second Pan-American Scientific Congress will meet in Washington in 1914. The State Department has asked for an appropriation of $50,000 for preliminary expenses, entertainment of delegates, and publication of the proceedings in English and Spanish.

The Trans-Sahara Railway.—The dormant project of a railway across the Sahara has been actively revived. A French commission charged with the task of ascertaining the most favorable route landed at Algiers in January, and proceeded to the southern terminus of the present south Oran railway, Colomb-Béchar, whence a march across the desert was to be undertaken. The party is led by Capt. Nieger, of the colonial infantry; the second in command is Capt. Cortier of the same service; while the geologist of the expedition is M. René Chudeau; all three are well-known Sahara explorers. Lieut. Leibe will proceed north from Senegal to meet the party. The tentative plan for the railway contemplates a line south from Algeria, branching at some point not yet selected; one branch to proceed *via* Timbuktu to Senegal, the other to Lake Chad.

Another Greenland Expedition.—An account of Dr. de Quervain's plans for crossing Greenland from west to east (Disco Bay to Angmagsalik), during the summer of 1912, has been published in these columns (February 3rd, 1912, p. 103). Now it is announced that an attempt will be made by another party to cross the island in the opposite direction and farther to the north; viz., from Cape Bismarck to Upernivik. The second party, comprising the Danish Capt. Koch, the German meteorologist, Dr. Alfred Wegener, and the German botanist, Herr Lundager, all of whom were members of the "Denmark" expedition of 1906-08 to northeast Greenland, expects to land at Cape Bismarck with 15 Iceland ponies about August 1st of this year and push northward about 90 miles to Queen Louise Land, where winter quarters will be established in November. In May, 1913, the party expects to start with 6 sledges for Upernivik. A depot was established as far to the eastward of that place as possible by Herr Lundager last summer. It is believed the crossing can be accomplished in from 2 to 3 months.

Severe Drought in Tropical America.—Consular reports from Curacao, Dutch West Indies, and from British Guiana indicate that the worst drought in years prevailed along the northern coast of South America and in the islands adjacent during 1911 and the early month of 1912. At Curacao during the rainy season of 1911-12, extending from October to February, the rainfall was only 2.71 inches, as compared with 17.55 inches during the corresponding period of 1910-11; the crops are reported to have failed, farm animals are dying; and water for human consumption is scarce and expensive. It is said that it will take the colony many years to recover from the effects of this drought. In British Guiana it is expected that the sugar crop will be reduced 50 per cent by the drought. Throughout the three Guianas the drought has had a disastrous effect upon the production of balata, or chicle, which is largely exported to the United States for use in making chewing gum. The bully tree, from which the balata of commerce is obtained, will not yield this gum unless the rainfall is ample; moreover, the balata forests are inaccessible when the rivers are low, as they are at present.

The Late Abbott Lawrence Rotch

A Pioneer Investigator in Aerology

By Andrew H. Palmer, A.M., Research Assistant, Blue Hill Observatory

IF there is one science in which the United States has stood on a par with European nations in its contributions it is meteorology, the science of the atmosphere. It is no exaggeration of the truth to say that no other single nation can boast of a more formidable list of pioneer investigators in one branch of knowledge. In meteorology America is rightly proud of such men as Ferrel, Loomis, Espy, Redfield, Henry, Abbe and Rotch. Each has been associated with one particular field of research and each has left his name indelibly stamped upon the facts and principles he helped to determine. It is with the man whose name is quoted last in the foregoing list that this sketch is concerned. At the time of his death, on April 7th last, he was not only America's most prominent exponent in aerology, that branch of meteorolgy which deals with the free air aloft, but also among the half-dozen leading aerologists of the world.

Abbott Lawrence Rotch was born in Boston, January 6th, 1861. His training was received through private tutors, foreign travel, and at the Massachusetts Institute of Technology, from which he was graduated in 1884, receiving the S.B. degree. Just as every other intelligent young man has a particular field of knowledge to which his fancy turns, so Rotch became interested in meteorology, partly as a result of his attendance at the Saturday night round-table conferences of the Boston Scientific Society and the frequent meetings of the New England Meteorological Society. Born to an aristocracy of wealth as well as of genius, Mr. Rotch visited the more prominent European observatories in 1884 and 1885, and in the latter year established Blue Hill Meteorological Observatory on the summit of Great Blue Hill, 635 feet above the sea-level, and ten miles south of Boston. The history of the observatory is really a biography of its founder, so closely are the two related. From its very beginning the progress of the observatory was marked by innovations, as far as America was concerned, which have since been widely adopted. To quote Prof. Frank Waldo, "There can be no doubt that the work of Blue Hill Observatory has had a very great quickening influence in the recent developments in observational meteorology in this country. Not only has its thoroughly independent attitude and scientific spirit enabled it to make usefulness and not policy its watchword, but it has also permitted it to improve the older traditions of American meteorology, by adding to them the best features of European meteorology." The newly established institution was equipped with self-recording instruments which in variety and completeness even excelled the older Draper Observatory in Central Park, New York city. The successful use of automatically recording instruments so impressed Gen. Hazen, the chief signal officer, when he visited Blue Hill in 1885, that they were soon officially adopted and have since been in use in government stations throughout the country. The observatory very early undertook the issue of local weather forecasts, which were printed in the Boston newspapers. Their success also impressed the government; for they were adopted by the Signal Service, only general or regional forecasts having been attempted by the government up to that time. It is not generally known that the cyclo-style weather maps which have given to the public a graphic representation of the weather conditions each day over the whole United States, were first issued privately in May, 1886, from the Boston Signal Service station by Messrs. Cole and Rotch at the latter's expense. The observatory also led the way by means of a good example in the use of the international form of publication of weather data and in the employment of the metric system of units wherever possible.

But it is through its contributions to aerology that Blue Hill Observatory has won enduring fame. Here on August 4th, 1894, the first registering meteorological instrument was sent aloft by means of a kite. Since that date more than a thousand successful soundings have been made, and the instrument has at times been lifted to heights greater than three miles above the earth. The honor of making the first thorough exploration of the lower mile of free air belongs to the observatory. The kite method of aerial sounding has since been adopted all over the civilized world, and on twenty-three predetermined days each year flights are made at forty different stations, while some, like the Mount Weather Observatory of the United States Weather Bureau, have daily kite flights throughout the year. Both the method of observation as well as much of the apparatus in use at the present time have direct precedents in the experiments on Blue Hill. Mr. Rotch also conducted the first American researches with sounding-balloons—small, hydrogen-filled rubber bags carrying recording instruments which are brought back to the ground by means of parachutes after ascending to heights of ten to fifteen miles. He was also the first one in this country to use the pilot-balloon to determine wind velocity and direction aloft by means of trigonometrical observations. Both forms of balloons are now used by the United States Weather Bureau. It is obvious from the foregoing facts that the observatory has been especially strong in the experimental field of pure science and in the development of new methods of observation, activities which a government service can not undertake when narrow-minded legislators continually demand immediate results.

THE LATE A. LAWRENCE ROTCH

A man of Rotch's caliber does not regard personal honors in the same light with which the layman views them. They came unsolicited to him, however. Harvard conferred upon him the honorary A.M. degree in 1891 and made him professor of meteorology in 1906. He was a member of practically every honorary scientific society of national importance. "A prophet is not without honor, save in his own country," however, and he was better known among the scientists of Europe than among those at home, and was an honorary member of many foreign learned societies. While a member of the International Jury of Awards at the Paris Exposition in 1889 he was made Chevalier of the Legion of Honor. On him were also conferred the Prussian Order of the Crown in 1902 and the Order of the Red Eagle in 1905. His chief delight was that of participating in scientific investigations. He served on the International Solar and Aeronautical Commissions from their very inception, and co-operated with various expeditions sent to distant places to advance our knowledge of the atmosphere on land as well as above the sea. The most notable of the latter was his association with MM. L. Teisserenc de Bort in 1905 to 1906 when an expedition was sent to study the trade winds of the tropical Atlantic. Just before his last and only illness he was making plans to co-operate in the proposed Crocker Land expedition, his interest again reverting to the meteorological considerations. Not realizing that death was so near he had engaged passage in order to attend the seventh meeting of the International Commission for Scientific Aeronautics, from whose gatherings he was never absent.

Of recent years Prof. Rotch's attention has naturally turned to aeronautics. Having made several balloon voyages while abroad, and because of his thorough knowledge of kites and of the air aloft, his opinions were frequently sought by experimenters, and among his correspondents were many prominent in aviation, both at home and abroad. He was president of the Harvard Aeronautical Society and a governor of the Aero Club of America. Capt. Moedebeck, who until his death two years ago was the leading German authority on aerial navigation, referred to Prof. Rotch as one of the two Americans who did the pioneer aerological investigation which has rendered possible the remarkable progress in the art of aerial navigation during the last decade.

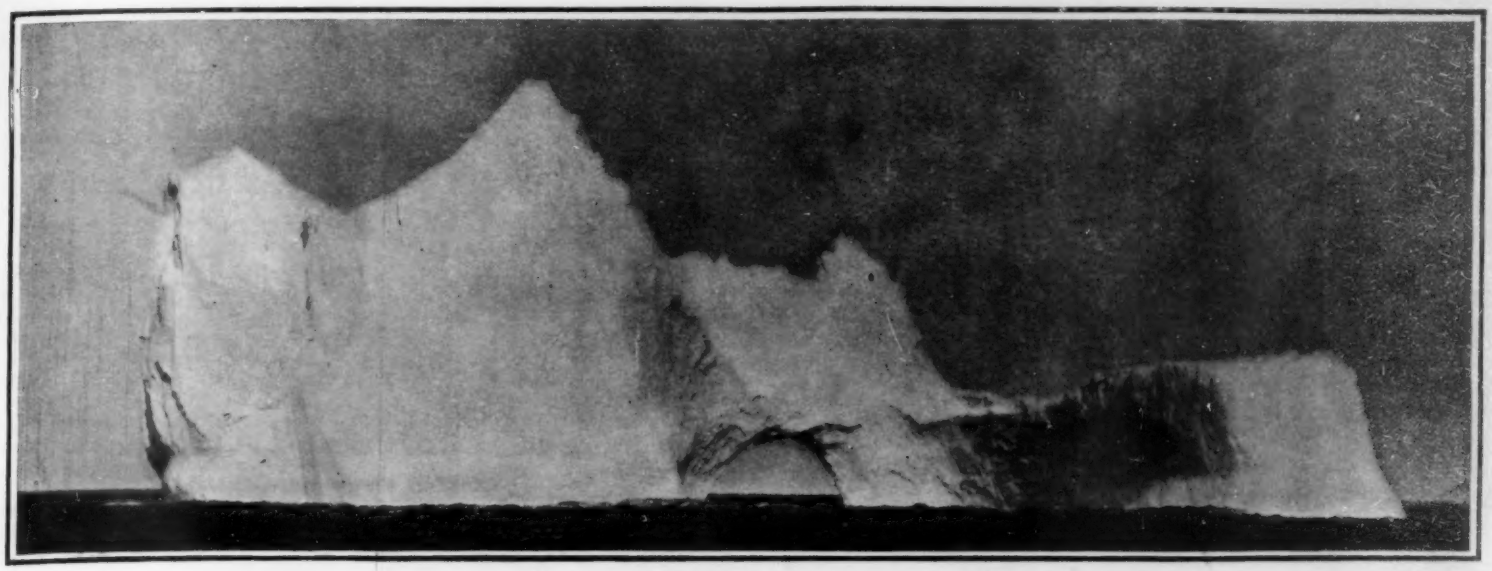
In the midst of his researches Prof. Rotch found time to lecture occasionally, while his contributions to periodicals number over two hundred titles. He was also the author of "Sounding the Ocean of Air," 1900, "The Conquest of the Air," 1909, and, with the writer of this sketch, published the "Charts of the Atmosphere" less than a year ago.

Though a member of clubs in Boston, New York and Washington, Prof. Rotch was essentially a home man, and divided his time between his home and the observatory. Prof. Rotch's dominant interest was Blue Hill Observatory and the science with which it was concerned. In accordance with his last will and testament the property, with an endowment of $50,000, becomes the property of Harvard University. In one of his last papers he wrote, "It is to be hoped that the observatory may have its existence prolonged, with unchanged environments and methods of observation, to the close of the century; but since this transcends the life of one individual, the duty must devolve on the university to which it is allied."

The castle-like structure which crowns the summit of Great Blue Hill remains a fitting monument to a great life-work. Of its record, which may properly be considered the founder's contribution to knowledge, Prof. Waldo writes, "I venture to express the opinion that when the history of meteorology during the latter half of the nineteenth century is written, the Blue Hill Observatory will be assigned the foremost place in American observational meteorology, and this judgment will be based not only on the observations which have been made, but also on their proper discussion and correlation with allied branches of this science of the atmosphere."

American Railways in Uruguay

ACCORDING to the London *Times*, the first concession obtained by American capital to build railways in Uruguay, has led to the active beginning of work on a line that is to run from Colonia (where a fully equipped modern port will be built), opposite Buenos Aires, almost due north to San Luis, on the northern frontier, where it will be linked up with the Brazilian system. This line, known as the Trans-Uruguayan, which with its branches will have a mileage of 425, forms part of a network which it is proposed to carry over virtually the whole continent of South America. Negotiations are now nearly complete for another line, in which American capital is interested, to run from Coronilla, on the Atlantic Ocean, where also a port will be built, to Santa Rosa, on the Uruguay River. This line, like the other, is but the initial step in a system that is expected to ramify into Brazil Argentina and Paraguay.



The size of an iceberg varies. A berg from 60 to 100 feet to the top of its walls, whose spires or pinnacles may reach from 200 to 250 feet in height and whose length may be from 300 to 500 yards, is considered of ordinary size.

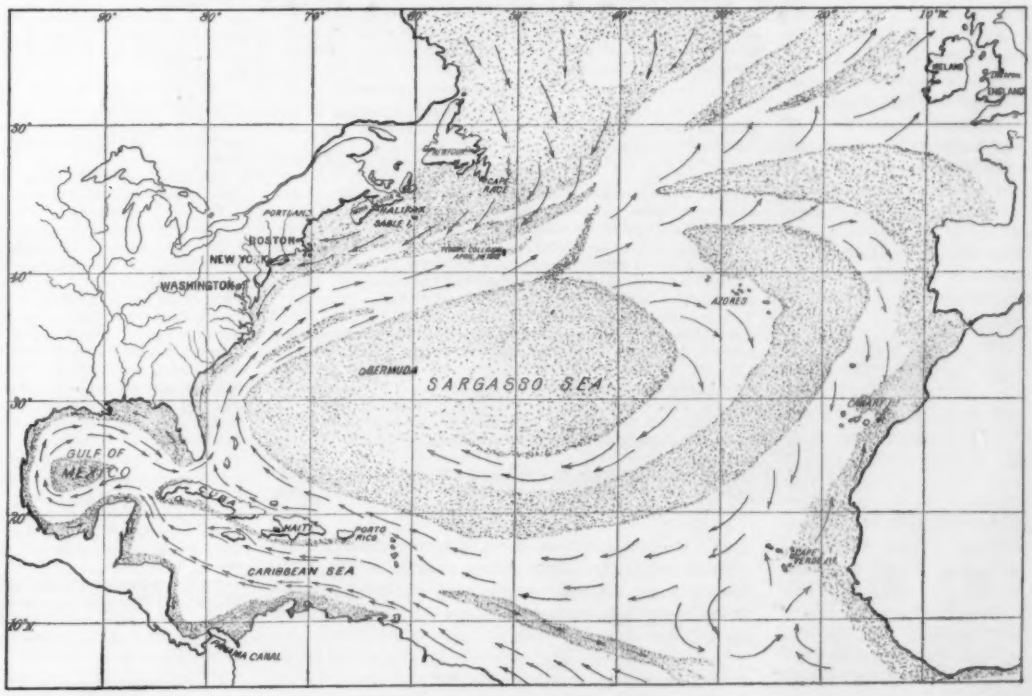
What We Know About Icebergs

How They Are Formed; Their Characteristics; How They Drift; Precautions Taken to Protect Shipping Against Them

AN iceberg is a fragment of a glacier. Inch by inch the huge river of ice which we call a glacier creeps toward the sea, and here its projecting end is broken off by the action of the waves. "Calving" is the technical name which has been given to this process of breaking bergs from glaciers. It is a process that occurs all the year around, but more frequently in summer than in winter, a process, moreover, that sets adrift thousands of huge ice masses during the course of a year.

The icebergs that find their way into the paths of transatlantic liners come down from the coast of Greenland; for the interior of Greenland is a huge ice sheet fringed by mountains and promontories. Deep fiords reach far into the inland ice, terminated only by the sheer walls of giant glaciers. Sometimes, however, the ice slides down in broad expanses close to the margin of the sea.

In the vicinity of the great Bank of Newfoundland icebergs appear in greatest numbers—in other words, athwart the transatlantic oceanic steamer routes. According to data collected by the United States Hydrographic Office, to which we are indebted for most of the information that appears in this article, icebergs have been seen in April, May, and June as far south as the thirty-ninth degree of latitud and as far east as longitude 38 degrees 30 minutes west of Greenwich. Indeed, floating ice may be encountered anywhere in the North Atlantic Ocean north of the fortieth degree of latitude at any season of the year.



Currents of the Atlantic Ocean in winter and early spring.

How Icebergs Drift Southward.

It is the Labrador current that carries an iceberg southward. But ere it reaches the high seas, the berg may be subjected to many mishaps. It may ground in the Arctic basin; it may be stranded on the shores of Labrador and break up; it may disintegrate entirely. The numerous islands, bays, headlands, shoals, and reefs that constitute the coast of Labrador mercifully obstruct the passage of many icebergs and prevent them from reaching the waters of the North Atlantic.

Bergs, when first liberated on the west Greenland shore, are out of the strongest sweep of the southerly current, and they may take some months to find their way out of Davis Strait, while again others may at once drift into the current and move unobstructed until demolished in the Gulf Stream.

Little is known of the Labrador current, beyond the fact that it skirts the coast of Baffin Land and Labrador; that its usual rate of motion is from 10 to 36 miles a day; that its breadth and depth are uncertain; and that it occasionally ceases altogether. The cause of the Labrador current's vagaries and the whole subject of ice movements is one that scarcely lends itself to prediction. It is simply known in a general way that on the Grand Bank of Newfoundland bergs often move southward or southeastward. Those that drift westward of Cape Race usually pass between Green and St. Pierre banks.

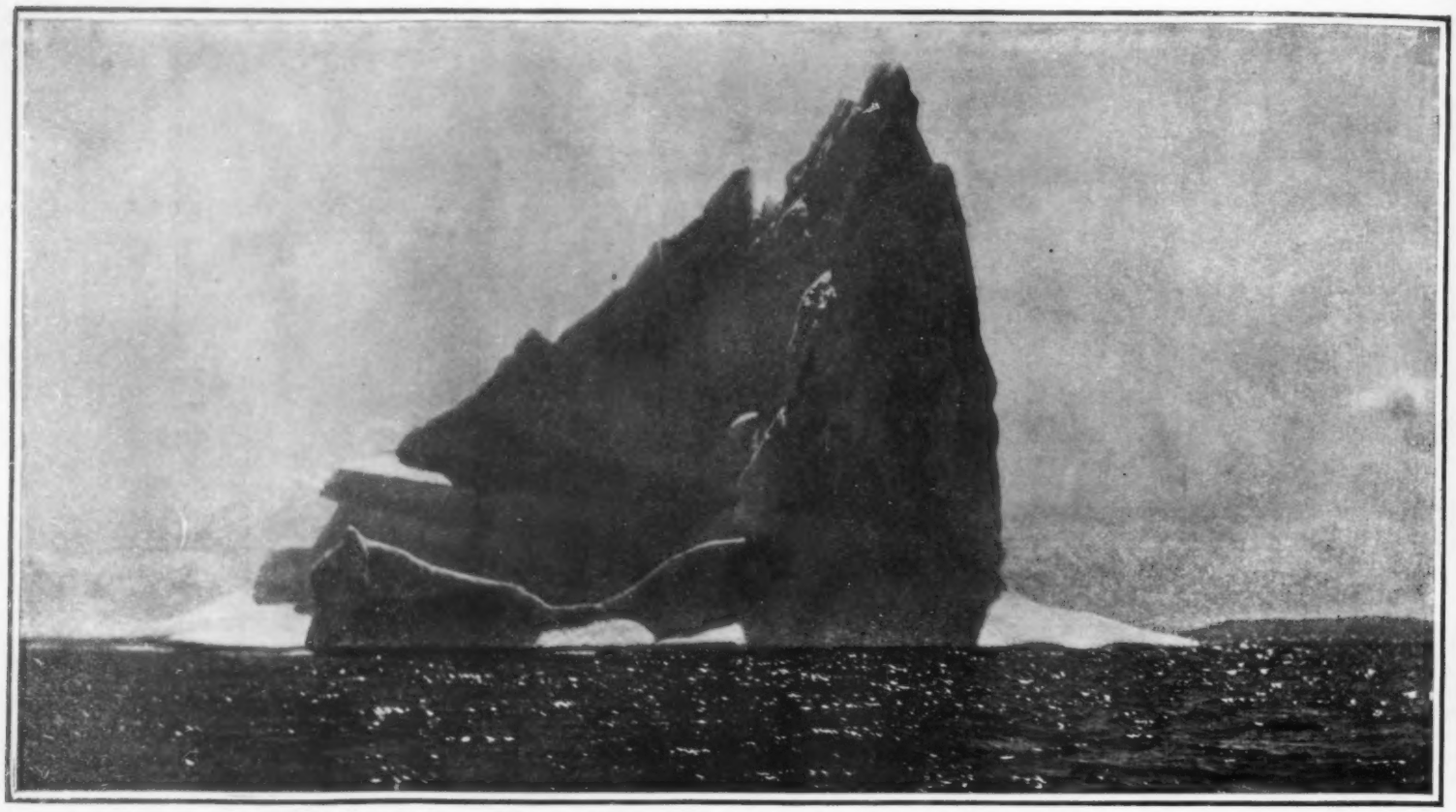
The iceberg that glints in the path of a steamer on the Grand Bank may not be of this year's "calving." Indeed, it may have been broken from its parent glacier years before. It has been figured by the Hydrographic Office that if bergs were liberated principally in July and August, they should reach the transatlantic routes in December and January. This, however, is rare. Evidently the irregular coast of Labrador must considerably arrest the flow, when it is considered that bergs are most numerous during the early summer off the Bank. Of two bergs set adrift on the same day, one may reach the Grand Bank two years before the other.

The advancing limit of Arctic ice, having in its train an endless procession of masses drifting down from the North, reaches the northern average limit of the Gulf Stream in the month of April, and having spread itself along this line both East and West of the 50th meridian of longitude, the ice disintegrates and rapidly disappears. Still, after reaching this limit of southward movement, many bergs, on account of their deep immersion, find their way to the westward even within the current of the Gulf Stream.

The locality in which ice of all kinds is apt to be found during the months of April, May, and June lies between latitude 42 degrees 45 minutes and longitude 47 degrees 52 minutes west of Greenwich. Here the Gulf Stream and the Labrador current meet; here the movement of the ice is influenced sometimes by the one and sometimes by the other of these currents; and here in latitude 41 degrees 46 minutes and longitude 50 degrees 14 minutes the "Titanic" came to grief.

The Menace of the Iceberg.

It is the huge mass of an iceberg that the mariner has most to fear. While it may vary in size, an ordinary iceberg will measure from 60 to 100 feet to the top of its walls, and it will have spires or pinnacles towering from 200 to 250 feet above a base that may be from 300 to 500 yards in length. Only one-eighth or one-ninth of the entire mass lies above water. Mass, let it be borne in mind, is a different quantity from height. Hence, the statement sometimes found in books that the depth of a berg under water may be from eight to nine times the height above water is incorrect. It is possible to have a berg as high out of water as it is deep below the surface; for if we imagine a large, solid lump of any regular shape, which has a very small sharp high pinnacle in the center, the height above water can easily equal the depth below. The Hydrographic Office has recorded the case of a berg, grounded in the Strait of Belle Isle in sixteen fathoms of water, that had a thin spire about 100 feet in height. Often the bergs are so nicely balanced



Icebergs are often most fantastic in shape. Here is one that looks like a ship under sail. Sometimes a berg is found with spires, domes, minarets and peaks, while others still are pierced with deep indentations or caves. Small cataracts precipitate themselves from the large bergs.

that the slightest melting of their surfaces causes a shifting of the center of gravity and a consequent turning over of the mass into a new position.

Disintegration occurs very rapidly. On the coast of Labrador in July and August, when bergs are packed thickly together, the noise of rupture is often deafening. When they are frozen, the temperature is very low, so that on exposure to a thawing temperature the tension of the exterior differs from that of the interior. In other words, the berg becomes like a huge Prince Rupert's drop, which, as every one knows, is a drop formed by allowing molten glass to fall into cold water. It is said that the concussion of gun fire will sometimes break up a berg, so unequal is the tension within and without.. During the day, water, the result of melting, finds its way into crevices. At night it freezes, expands, and splits the berg. The greater the splitting action the more rapid is disintegration, because new surface is exposed. Were it not for these circumstances, large bergs would remain intact years before they melted completely away.

The Queer Shapes of Icebergs.

Not only is the huge mass of an iceberg a source of danger, but its eccentric shape as well. The weird pinnacles, spires, domes, minarets, and peaks, that remind one of castles fashioned by some genius for the pleasure of some whimsical fairy princess, find their counterpart in unseen, outlying spurs that project under water and that are fully as dangerous as any reef. The United States Hydrographic Office has called attention to the accident sustained by the British steamship "Nessmore," which ran into a berg and stove in her bows. When she was docked a long score was found extending from abreast her fore rigging all the way aft, just above the keel. Four frames were broken, and the plates were almost cut through. As there was clear water between the ship and the berg after the first collision, it was evident that the ship had struck a projecting spur after her helm had been put over.

Warning the Mariner.

Since the routes taken by most of the vessels that ply between Europe and the United States pass directly through that part of the Grand Bank which is most thickly sown with icebergs, it becomes interesting to ascertain what precautions are taken to warn mariners of their danger. By means of the wireless telegraph each master informs the vessels in his immediate radius of icebergs and field ice that he has sighted. His warning is either directly communicated by wireless to land or relayed from ship to ship until it eventually reaches the United States Hydrographic Office at Washington, D. C. Wrecks, derelicts, ice, and other obstructions to navigation are promptly reported. On the basis of these reports the United States Hydrographic Office prepares a daily memorandum which is sent to sixteen branch Hydrographic Offices along the Atlantic Coast, the Great Lakes, the Pacific Ocean, and the Gulf of Mexico. In these branches the masters of sailing vessels and steamers may note the probable location of obstructions that have been reported. The daily memorandum issued by the United States Hydrographic Office at New York on April 15th last, a memorandum now of tragic interest because of the "Titanic" disaster, reads as follows:

NORTH ATLANTIC OCEAN.

OBSTRUCTIONS OFF THE AMERICAN COAST.

March 28th.—Latitude 24 degrees 20 minutes, longitude 80 degrees 02 minutes, passed a broken spar projecting about 3 feet out of water, apparently attached to sunken wreckage.—"Evelyn" (steamship) Wright.

OBSTRUCTIONS ALONG THE OVER-SEA ROUTES.

April 7th.—Latitude 35 degrees 20 minutes, longitude 59 degrees 40 minutes, saw a lower mast covered with marine growth.—"Adriatic" (Italian steamship) Cevascu.

ICE REPORTS.

April 7th.—Latitude 45 degrees 10 minutes, longitude 56 degrees 40 minutes, ran into a strip of field ice about 3 or 4 miles wide extending north and south as far as could be seen. Some very heavy pans were seen.—"Rosalind" (British steamship) Williams.

April 10th.—Latitude 41 degrees 50 minutes, longitude 50 degrees 25 minutes, passed a large ice field a few hundred feet wide and 15 miles long extending in a N.NE. direction.—"Excelsior" (German steamship). (*New York Herald*).

Collision with Iceberg.—April 14th.—Latitude 41 degrees 46 minutes, longitude 50 degrees 14 minutes, the British steamer "Titanic" collided with an iceberg seriously damaging her bow; extent not definitely known.

April 14th.—The German steamer "Amerika" reported by radio telegraph passing two large icebergs in latitude 41 degrees 27 minutes, longitude 50 degrees 08 minutes.—"Titanic" (British steamship).

April 14th.—Latitude 42 degrees 06 minutes, longitude 49 degrees 43 minutes, encountered extensive field ice and saw seven icebergs of considerable size.—"Pisa" (German steamship).

J. J. KNAPP,
Captain, U. S. Navy, Hydrographer.

From this daily memorandum it will be seen that the "Titanic" had been informed by the "Amerika" of the proximity of two large icebergs. A few hours later she met her doom.

Day after day the United States Hydrographic Office keeps mariners informed of the dangers that lurk off the Grand Bank. Through the courtesy of Lieut. John Grady in charge of the Branch Hydrographic Office at New York, the writer was permitted to examine reports that passed through the office recently. On April 10th at 8:20 A. M. the steamship "Excelsior," in latitude 41 degrees 50 minutes north, passed through field ice only a few hundred feet broad, but at least 15 miles in extent in a north northeasterly direction. On the 11th the "Carmania's" captain reported about thirty large icebergs in latitude 41 degrees 54 minutes and longitude 50 degrees 30 minutes west, as well as extensive field ice. "Some large bergs," to quote the "Carmania's" captain, were "about 400 feet long and from one-quarter to one-half a mile in width."

Signs of Icebergs.

How can a ship's commander know whether ice is near or not? On that point the United States Hydrographic Office gives the following information:

Before ice is seen from deck the ice blink will often indicate its presence. This is readily understood when it is known that it is caused by the reflection of the rays of light from the sun or moon. On a clear day over the ice on the horizon the sky will be much paler or lighter in color and is easily distinguishable from that overhead, so that a sharp lookout should be kept and changes in the color of the sky noted.

On a clear day icebergs can be seen at a long distance, owing to their brightness, and at night to their effulgence. During foggy weather they can be seen through the fog by their apparent blackness, if such a term can be applied.

They can also be detected by the echo from the steam whistle or fog horn. This should be remembered, since, by noting the time between the blast of a whistle and the reflected sound, the distance of the object in feet may be approximately found by multiplying by 550.

The presence of icebergs is often made known by the noise of their breaking up and falling to pieces. The cracking of the ice or the falling of pieces into the sea makes a noise like breakers or a distant discharge of guns, which may often be heard a short distance.

The absence of swell or wave motion in a fresh breeze is a sign that there is land or ice on the weather side.

The appearance of herds of seals or flocks of birds far from land is an indication of the proximity of ice.

The temperature of the air falls as ice is approached, especially on the leeward side; but generally only at an inconsiderable distance from it. The fall of the temperature of the sea water is sometimes a sign of the proximity of ice, although in regions where there is an intermixture of cold and warm currents going on, as at the junction of the Labrador Current and the Gulf Stream, the temperature of the sea has been known to rise as the ice is approached. If a berg be grounded, water flowing past it will be lowered in temperature and thus give an indication of its presence. Change of temperature may therefore serve as a warning, and frequent observations, both of the temperature of the air and the sea, should be taken and considered.

SIGNALS IN RELATION TO ICE.

Information as to wind, temperature, weather indications, and the state of the ice can be obtained by communicating with the marine signal stations of Newfoundland, St. Pierre, and Canada. These are situated at Cape Race, Cape Ray, Belle Isle, Chateau Bay, Amour Point, Galantry Head (St. Pierre), and St. Paul Island.

Wireless telegraph stations are operated for the Department of Marine and Fisheries of the Dominion of Canada by the Marconi Wireless Telegraph Company at most of these stations, and vessels fitted with Marconi apparatus can communicate with them.

A Railway from Egypt to India

ONE of the boldest of railway projects is the plan recently formulated by an English engineer to construct a 2,200-miles line from Port Said, Egypt, across Arabia to Basra at the head of the Persian Gulf, and thence across Persia to join the Indian railways at Quetta. To geographers this plan is most alluring, as its execution would mean an immense addition to our, at present, very meager knowledge of the desert interior of Arabia.

Wireless in Uruguay

THE government of Uruguay has established a great wireless station of the Telefunken system at Cerrito, with a radius of 1,000 miles. The plant occupies 9 acres of land, on which have been erected two towers of steel and masonry 197 feet high, and a 6-room building. An underground cable connects the station with the central post office, which will be the distributing point for the wireless messages received.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

A Good Roads Suggestion

To the Editor of the SCIENTIFIC AMERICAN:

Your Good Roads Number interested me greatly. I wish to call your attention to the fact that many of the State roads of New York State parallel the railroad and are not in places where the agricultural interests are benefited as they should be. The State road which is being built from Albany to Binghamton parallels the Delaware and Hudson Railroad.

Why not build State roads from the inland towns to the railroad towns and give the motor truck a chance to prove its possibilities to the general public? Many automobile owners would favor the idea, as it would open new pleasure grounds and new fields for the introduction of the automobile and motor truck. A little scientific management is needed.

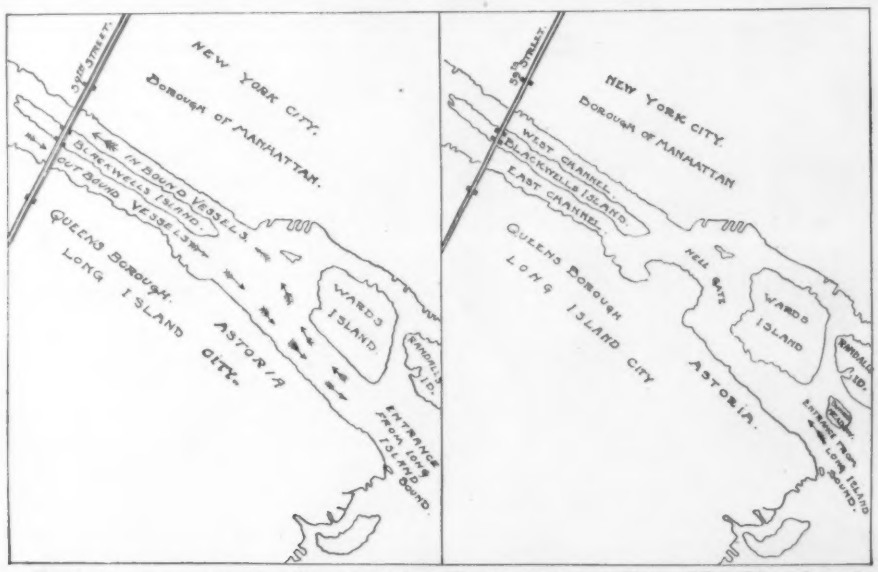
Stewart, N. Y. R. C. JONES

Opening of the East River Channel

To the Editor of the SCIENTIFIC AMERICAN:

In the *Times* of February 18th I read an article which referred to the removing of obstacles in the East River, and especially in Little Hell Gate, with the object of lessening the current. Having been a resident of Astoria for more than twenty years, I have often thought that the channel near Hell Gate could be widened, which no doubt would eliminate to a great extent the strong currents. I have inclosed two maps, one showing the present condition of channels, and another a suggested improvement. This would involve the removing of the peninsula in the neighborhood of Ninety-second Street, Astoria, a part of the easterly portion of Ward's Island, and the Sunken Meadows. This no doubt would cost a great deal, but I believe it would in a very short time pay for itself, and be of great benefit to New York city in particular and to all the towns and cities situated on Long Island Sound. The easterly channel from Ninety-second to Forty-second streets is very little used, while the westerly one is very often crowded. Only once in twenty years do I remember having seen an ocean steamer use the eastern channel, and I think the reason is chiefly that it is so hard for a large vessel to make the turn at Hell Gate, either in or outbound, on account of the peninsula at that point. It would be quite easy to establish a rule of the road as per sketch. With such an entrance from the east, it ought to encourage more boat traffic in farm and garden products from Sound ports, and a safe passage for the immense coal-carrying trade and the 1,000-ton canal barges. Finally, in time of war it will provide a quick route for war vessels without being harassed by the enemy. This would be a fine task for our Isthmian canal builders, who will soon be out of a job, and the benefits relatively as great for the amount of money expended.

Flushing, L. I., N. Y. JOHN CLARK.



Showing improvement in East River channels. **Showing present condition of East River channels.**

Merchant Marine a National Issue

To the Editor of the SCIENTIFIC AMERICAN:

Your editorial in the issue of March 9th, "Merchant Marine a National Issue," indicates the growth of the interest the American people are taking generally in having the American merchant marine a universal factor on the trade routes of the seven seas, instead of its being confined, as it is to-day, to a merely coastwise proposition.

You say: "In view of the marked evidence that the average citizen of the United States is anxious to see American shipping restored to its one-time proud position, the apathy of Congress is, to say the least, bewildering."

Why? When till the last year has the question of an American merchant marine become a burning subject of inquiry?

'Tis true, special interests have advocated its upbuilding through the aid of subsidies, and had subsidies been passed, a few steamship lines would have been called into existence which would have profited some shipbuilding interests and the owners of the lines enjoying the subsidies; but it would have no stimulating effect generally on American ship owning and operating in foreign trades.

Every advocate of subsidies has shown that the amount of the funds asked for, would only offset the additional cost of building steamers in American yards and the higher cost of operation under the American flag. Nothing in any argument advocated by those in favor of subsidies indicated that the freight rates to the American shipper would be reduced.

And if subsidized steamship lines would not lower freight rates, if subsidies would but allow a few only, American lines to exist, instead of dominating in the foreign deep-sea trade, what hope could there be for a steady expansion of American shipping in that direction? What hope that our American manufacturers would increase their sales in foreign markets through lowered freight rates and improved service?

Instinctively the American people felt this, and it goes far to explain the apathy exhibited by the American people to this manner of upbuilding the American merchant marine. It was plain that special interests only would benefit, and not the American people generally.

The building of the Panama canal—the expenditure of $400,000,000 almost—has become a factor that interests every American citizen. What benefits will accrue to the United States because of this outlay? What benefit will accrue to our shipping? What benefits will be realized by our merchants? That it is bound to stimulate trade and traffic is a self-evident proposition, but to what degree will the people of the United States benefit?

These are the questions that confront the American people to-day, and which are forcing them to take a deeper interest in reviving our deep-sea merchant marine than this generation has known.

Subsidies not appealing to public sentiment, the Democrats have taken up the system of preferential duties on imported goods brought in by American steamers, as advocated by Congressman Sulzer.

This is as objectionable as a direct subsidy and far more dangerous, as it is an indirect contribution by the government instead of a direct. It would give a practical monopoly in the carrying trade on certain routes to powerful interests, who import merchandise in cargo lots.

Anyone that has taken the trouble to look into the proposition, and who is familiar with the Payne-Aldrich bill, can readily figure up what a preferential duty on such a line as sugar would amount to, on a cargo of say 6,000 to 7,000 tons.

It would stimulate a few large interests to build steamers to do their own freighting, but it would make no appeal to the American people generally and it would fail to interest the American people in steamship owning as a broad investment proposition; and unless steamship owning can be made an investment proposition on the broadest lines, our deep-sea shipping will lack the force necessary to place it among the foremost shipping nations of the world.

Then how shall the start be made?

By repealing the ancient navigation laws. Congress should place Americans on as good a footing as do foreign governments their citizens. It has been shown over and over again that every ship-owning nation has a "free-ship" law, and even in "protected" Germany "free ships" and free shipbuilding material are the laws of the land.

And how this has stimulated the growth of ship owning and ship building in Germany! After an experience of forty years of these laws, Germany has become second to Great Britain only as a marine power; German shipyards have increased; their output has tremendously increased; they turn out leviathans in German shipyards to-day that rival those of Great Britain. They are in the front in marine engineering; they have developed the Diesel marine engine, and these new types of merchant steamers—some of them now ready for sea—promise to revolutionize the ocean carrying trade.

England developed the marine turbine, Germany the Diesel marine engine. The two greatest ship-owning nations and ship-building nations on the globe, and neither of them with a tithe of the resources of the United States in iron or steel, or in any of the great commodities that furnish ocean freights!

Yet we not only have languished under our navigation laws, we have decayed; the disease has nearly run its course; the patient needs a restorative, and a palliative like "preferential duties" is now prescribed. "Give us preferential duties," cries Sulzer; "for we took them in our youth."

Well, there are many things taken in youth, and people live in spite of them and not because of them; and preferential duties is not a stimulant; it's a soothing syrup, and if taken will keep us quiet for a while.

Give us "free ships" for foreign trade. It can do no harm to any American interest. As it is, reports indicate that American shipyards have all they can do to turn out steamers for the coastwise trade that the Panama canal will call into being. Give us "free ships" and make all shipbuilding material free. We will then have the foundation for an American merchant marine that can enter into competition with foreign owners, and Americans will not be handicapped by the higher cost of steamers.

The American merchant marine will then grow, and as it grows, the repairs will go to American shipyards. Our American shipyards will not be content to do repair work only, they will seek to build; and if we can trust the statements of one of Cramp's representatives, made before the Fisheries Committee at Washington, it will not be long ere the American cost of building will be as low as that of the foreign builder.

In the meantime our foreign trade needs the stimulus of competitive freight rates; organization should be effected; foreign agencies should be established, to prove the truth of your statement: "There is no surer sign of the masterful enterprise of a people, than the visible token presented by that bit of bunting floating from the taffrail of a thousand ships, scattered over ten thousand leagues of the world's highway, engaged in the nation's commerce in the myriad ports of the world." CHARLES DEPESEE.

Chicago, Ill.

A Curious Accident Due to a "Pipe" in a Rail

To the Editor of the SCIENTIFIC AMERICAN:

Some three or four weeks ago you published an article on "pipes" in rails which was very interesting. I have just returned from Florida, where I viewed a wreck of a freight train near Palatka on the Atlantic Coast line, caused by such a "pipe." The train wrecked was north bound, while the train which broke the rail was south bound. In conversation with officials of the road at the wreck, the above conclusion was arrived at by marks of the wheels of a derailed car of the south-bound train on the ties. This car "hopped" on again at a frog of a switch about forty rods south of the broken rail. I could not learn if the crew of the south-bound train were aware if they had a car off. The accident occurred in the night, and from the cuts in the ties it is probable that only a single truck was off, and only two wheels of that truck. The wheels that were off were on the opposite side from the broken rail. To say the least, it was a most puzzling affair to a layman.

The "pipe" extended at least four feet along the rail, as was plainly shown by the broken sections. I examined the broken parts very closely, and it appeared that the web joining the top and foot of the rail was defective. There was a rupture of the web from the "pipe" to the outside for about twelve inches along the rail. This was rusty and probably defective in the making. I think the rails were made in 1895.

Galesburg, Ill. F. C. WOODS.

Closing all hydraulically operated doors from the bridge.

Wreck of the White Star Liner "Titanic"

How the World's Greatest Steamship Went Down With 1,600 Souls

Closing water-tight door, above the water line, by hand power.

IN the long list of maritime disasters there is none to compare with that which, on Sunday, April 14th, overwhelmed the latest and most magnificent of the ocean liners on her maiden voyage across the Western Ocean. Look at the disaster from whatever point we may, it stands out stupefying in its horror and prodigious in its many-sided significance.

"Titanic" the Last Word in Naval Architecture.

The "Titanic" stood for the "last word" in naval architecture. Not only did she carry to a far greater degree than any other ship the assurance of safety which we have come to associate with mere size; not only did she embody every safeguard against accident, known to the naval architect; not only was there wrought into her structure a greater proportionate mass of steel than had been put into any, even of the recent giant liners; but she was built at the foremost shipyard of Great Britain, and by a company whose vessels are credited with being the most strongly and carefully constructed of any afloat.

Unusual Strength of Construction.

To begin with, the floor of the ship was of exceptional strength and stiffness. Keel, keelson, longitudinals and inner and outer bottoms, were of a weight, size and thickness exceeding those of any previous ship. The floor was carried well up into the sides of the vessel, and in addition to the conventional framing, the hull was stiffened by deep web frames—girders of great strength—spaced at frequent and regular intervals throughout the whole length of the vessel. Tying the ship's sides together were the deck beams, 10 inches in depth, covered, floor above floor, with unbroken decks of steel. Additional strength was afforded by the stout longitudinal bulkheads of the coal bunkers, which extended in the wake of the boiler rooms, and, incidentally, by their watertight construction, served, or rather, in view of the loss of the ship, we should say were intended to serve, to prevent water, which might enter through a rupture in the ship's outer shell, from finding its way into the boiler rooms.

Watertight Compartments and Pumps.

As a further protection against sinking, the "Titanic" was divided by 15 transverse bulkheads into 16 separate watertight compartments; and they were so proportioned that any two of them might have been flooded without endangering the flotation of the ship.

Furthermore, all the multitudinous compartments of the cellular double bottom, and all the 16 main compartments of the ship, were connected through an elaborate system of piping, with a series of powerful pumps, whose joint capacity would suffice to greatly delay the rise of water in the holds, due to any of the ordinary accidents of the sea involving a rupture of the hull of the ship.

Size as an Element of Safety.

Finally there was the security against foundering due to vast size—a safeguard which might reasonably be considered the most effective of all. For it is certain that with a given amount of damage to the hull, the flooding of one compartment will affect the stability of a ship in the inverse ratio of her size—or, should the water-tight doors fail to close, the ship will stay afloat for a length of time approximately proportional to her size.

And so, for many and good reasons, the ship's company who set sail from Southampton on the first and last voyage of the world's greatest vessel believed that she was unsinkable.

And unsinkable she was by any of the seemingly possible accidents of wind and weather or deep-sea collision. She could have taken the blow of a colliding ship on bow, quarter or abeam and remained afloat, or even made her way to port. Bow on, and *under the half speed called for by careful seamanship*, she could probably have come without fatal injury through the ordeal of head-on collision with an iceberg.

The One Fatal Peril.

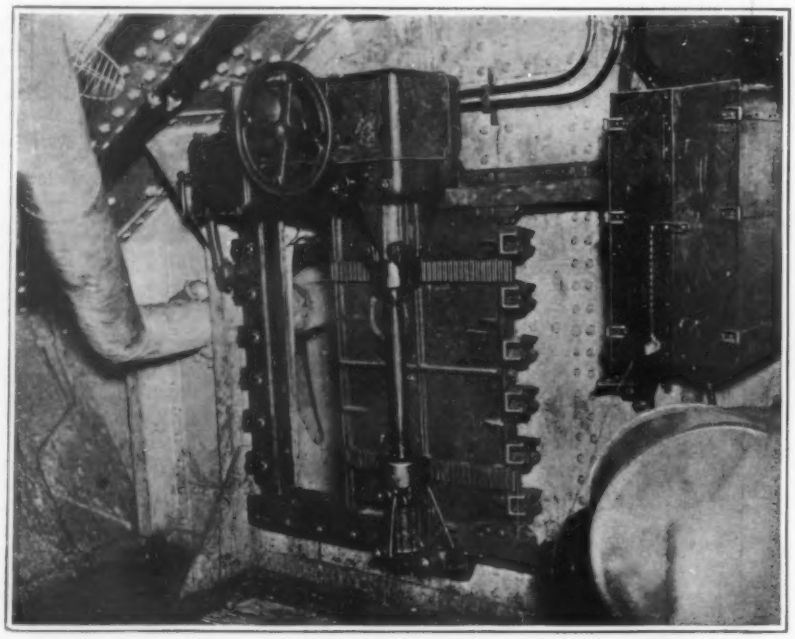
But there was just one peril of the deep against which this mighty ship was as helpless as the smallest of coasting steamers—the long, glancing blow below the waterline, due to the projecting shelf of an iceberg. It was this that sent the "Titanic" to the bottom in the brief space of 2½ hours, and it was her very size and the fatal speed at which she was driven, which made the blow so terrible.

The Climax of Seventy-five Years Development.

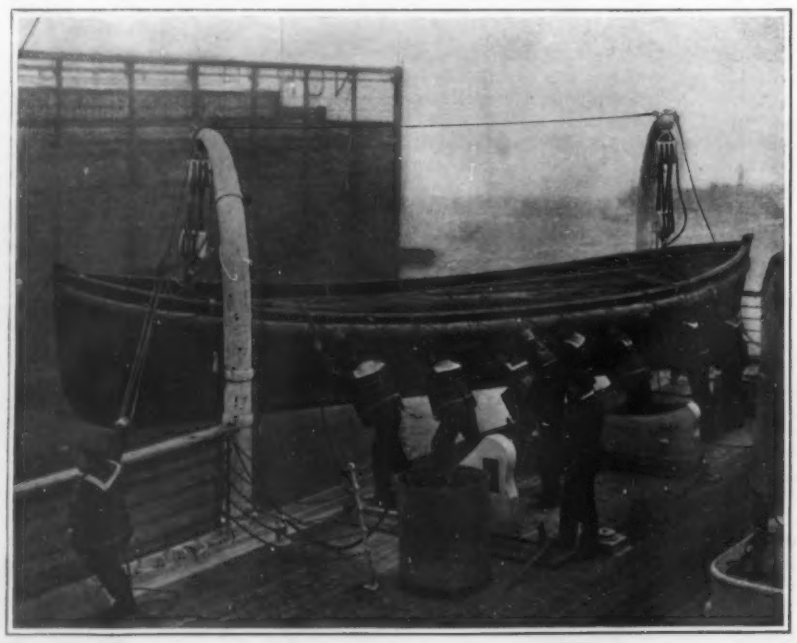
The "Titanic," with the sister vessel "Olympic," set the latest mark in the growth of the modern ocean liner toward the ship one thousand feet in length. The "Britannia" of 1840 was 207 feet long; the "Scotia" of 1862 was 379 feet and the "Bothnia" of 1874, 420 feet long. The "Servia" in 1881 was the first ship to exceed 500 feet with her length of 515 feet. In 1893 the "Campania" carried the length to 625 feet; and the first liner to pass 700 feet was the "Oceanic," whose length on deck was 704 feet. The "Mauretania" was 10 feet short of 800 feet; and then with an addition of nearly 100 feet the "Olympic" and "Titanic" carried the over-all length to 882½ feet; the tonnage to 46,000 and the displacement to 60,000. The indicated horse-power of the "Titanic" was 50,000, developed in two reciprocating engines driving two wing propellers and a single turbine driving a central propeller. The ship had accommodations for a whole townful of people (3,356, as a matter of fact), of whom 750 could be accommodated in the first class, 550 in the second, and 1,200 in the third. The balance of the company was made up of 63 officers and sailors, 322 engineers, firemen, oilers, and 471 stewards, waiters, etc.

Warned of the Iceberg Peril.

When the "Titanic" left Southampton on her fatal voyage she had on board a total of 2,340 passengers and crew. The voyage was unevent-



Electrically operated bulkhead of the general type installed on the "Titanic."



Life-boat drill on a German liner. Note cork jackets on the crew.

WRECK OF THE WHITE STAR LINER "TITANIC"

ful until Sunday, April 14th, when the wireless operator received and acknowledged a message from the "Amerika," warning her of the existence of a large field of ice into which her course would lead her toward the close of the day.

Full Speed Through the Ice Field.

The "Titanic" had been running at a steady speed of nearly 22 knots, having covered 545 miles during the day ending at noon April 14th; yet, in spite of the grave danger presented by the ice field ahead, she seems to have maintained during Sunday night a speed of not less than 21 knots. This is made clear by the testimony of Mr. Ismay, of the White Star Line, who stated at the Senate investigation that the revolutions were 72 as against the 78 revolutions which gave her full speed. She could make about 22½ knots at full speed, and 72 revolutions would correspond to about 21 knots.

The Captain Takes a Chance.

How such an experienced commander as Captain Smith should have driven his ship at high speed, and in the night, when he knew that he was in the proximity of heavy ice fields is a mystery which may never be cleared up. The night, it is true, was clear and starlit, and the sea perfectly smooth. Probably the fact that conditions were favorable for a good lookout, coupled with the desire to maintain a high average speed on the maiden trip of the vessel, decided the captain to "take a chance." Whatever the motive, it seems to be well established that the ship was not slowed down; and to this fact and no other must the loss of the "Titanic" be set down.

Had the "Titanic" been running under a slow bell, she would probably have been afloat to-day.

The Fatal Blow.

There were the usual lookout men at the bow and in the crow's nest, and officers on the bridge were straining their eyes for indications of the dreaded ice, when the cry suddenly rang out from the crow's nest, "Berg ahead, and an iceberg loomed up in the ship's path, distant only a quarter of a mile. The first officer gave the order "Starboard your helm." The great ship answered smartly and swung swiftly to port. But it was too late. The vessel took the blow of a deadly, underwater, projecting shelf of ice, on her starboard bow near the bridge, and before she swung clear, the mighty ram of the iceberg had torn its way through plating and frames as far aft as amidships, opening up compartment after compartment to the sea.

Thus, at one blow, were all the safety appliances of this magnificent ship set at naught! Of what avail was it to close water-tight doors, or set going the powerful pumps, when nearly half the length of the ship was open to the inpouring water. It must have taken but a few minutes' inspection to show the officers of the ship that she was doomed.

Half Speed Would Have Saved the Ship.

And yet that underwater blow, deadly in its nature, would scarcely have been fatal had the ship been put, as she should have been, under half speed. For then *the force of the reactive blow would have been reduced to one-fourth.* The energy of a moving mass increases as the *square* of the velocity. The 60,000-ton "Titanic," at 21 knots, represented an energy of 1,161,000 foot-tons. At 10 knots, her energy would have been reduced to 290,250 foot-tons. Think of it, that giant vessel rushing on through the ice-infested waters, was capable of striking a blow equal to the combined broadsides of the twenty 12-inch guns of the "Delaware" and "North Dakota," each of whose guns develops 50,000 foot-tons at the muzzle!

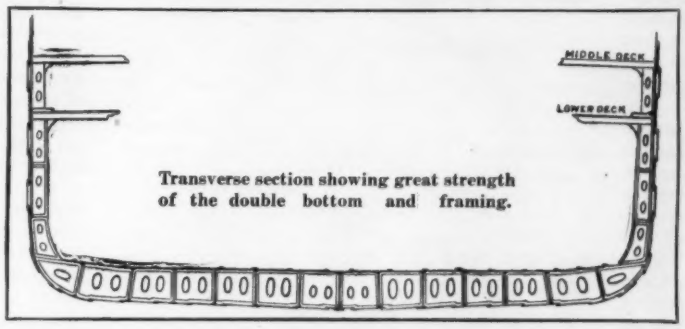
Work of One Million Foot-tons of Energy.

Little wonder is it that the ripping up of the frail 3/4-inch or 7/8-inch side plating and the 10-inch frames of the "Titanic" had little retarding effect upon the onward rush of the ship. So slight, in proportion to the enormous total energy of the vessel, was the energy absorbed in tearing open the hull or the bottom, or both, that the passengers were scarcely disturbed by the shock.

Newton's first law of motion "will be served."

But had the speed been only one-half and the energy one-fourth as great, the ship might well have been deflected from the iceberg before more than two or three of her compartments had been ripped open; and with the water confined to these, the powerful pumps could have kept the vessel afloat for many hours, and surely until a fleet of rescuing ships had taken every soul from the stricken vessel.

There is remarkable unanimity of testimony on the part of the survivors as to the slight nature of the shock; and this, coupled with the universal confidence in the unsinkability of the vessel, and the perfect quiet of both sea and ship, contributed no doubt to the marvellous absence of panic among the passengers.



Transverse section showing great strength of the double bottom and framing.

The Call for Help.

The wireless again, as in the case of the "Republic," proved its inestimable value. The collision occurred at 11:40 Sunday night in latitude 41.16 north, longitude 50.14 west. The call for help was heard by several ships, the nearest of which was the "Carpathia," which caught the message at 12:35 A. M. Monday, when she was 58 miles distant from the "Titanic." Setting an extra watch the captain crowded on all speed, reaching the scene of the disaster by 4 A. M.

The Mockery of the Boats.

Meanwhile, with the ship sinking swiftly beneath them, there remained as a last hope for that hapless multitude the boats. The boats! Twenty in all, with a maximum accommodation of say 1,000 for 2,340 human beings!

A Blot on the British Board of Trade.

For years the British Board of Trade, renowned the world over for the jealous care with which it safeguards the life of the individual, has been guilty of the amazing anomaly of permitting the passenger ships of the vast British merchant marine to put to sea carrying boat accommodation for only one out of every three persons on board. The penalty for such unspeakable folly, we had almost said criminal and brutal negligence, may have been long delayed; but it was to come this night in a wholesale flinging away of human life, which has left a blot upon this institution which can never be effaced! Had the regulations called for the boat accommodation demanded by the German or our own government, every soul on board the "Titanic" could have been transferred and picked up by the rescuing ship.

Sun Parlors Versus Safety.

We can conceive of no other motive than that of commercial expediency, the desire to reserve valuable space for restaurants, sun parlors or other superfluous but attractive features of the advertising pamphlet and the placard, for this criminal reduction of the last recourse of the shipwrecked to so small a measure.

No practical steamship man can claim that the provision of boat accommodation for the full complement of a ship like the "Titanic" was impracticable. The removal of deckhouse structures from the boat deck of the ship, and the surrender of this deck to its proper uses, would give ample storage room for the sixty boats, more or less, which would be necessary.

Plans for a Full Complement of Boats.

We present on the front page a study of this problem, in which the number of boats on the "Titanic" has been raised from 20 to 56 and the accommodation from about 1,000 to about 3,100. The boats are carried continuously along the whole length of the boat-deck rails, and between each pair of smokestacks two lines of four boats each are stowed athwartship. The chocks in which these boats rest are provided with gunmetal wheels, which run in transverse gunmetal tracks, countersunk on the deck. As soon as the boat at the rail is loaded and lowered, the next boat inboard is wheeled to the davits and loaded, ready to be picked up and swung outboard as soon as the tackle has been cast loose from the boat that has been lowered. This method has the great advantage that if the ship has a heavy list, practically the whole of the boats can be transferred to the low side of the ship.

Is a Man Worth More Than a Sheep?

"But," says the shipping man, "all this means heavy top weights, the loss of valuable space, and heavy costs for installation and maintenance;" to which we reply, in the words of a certain venerable book, "*By how much, then, is the life of a man worth more than that of a sheep!*"

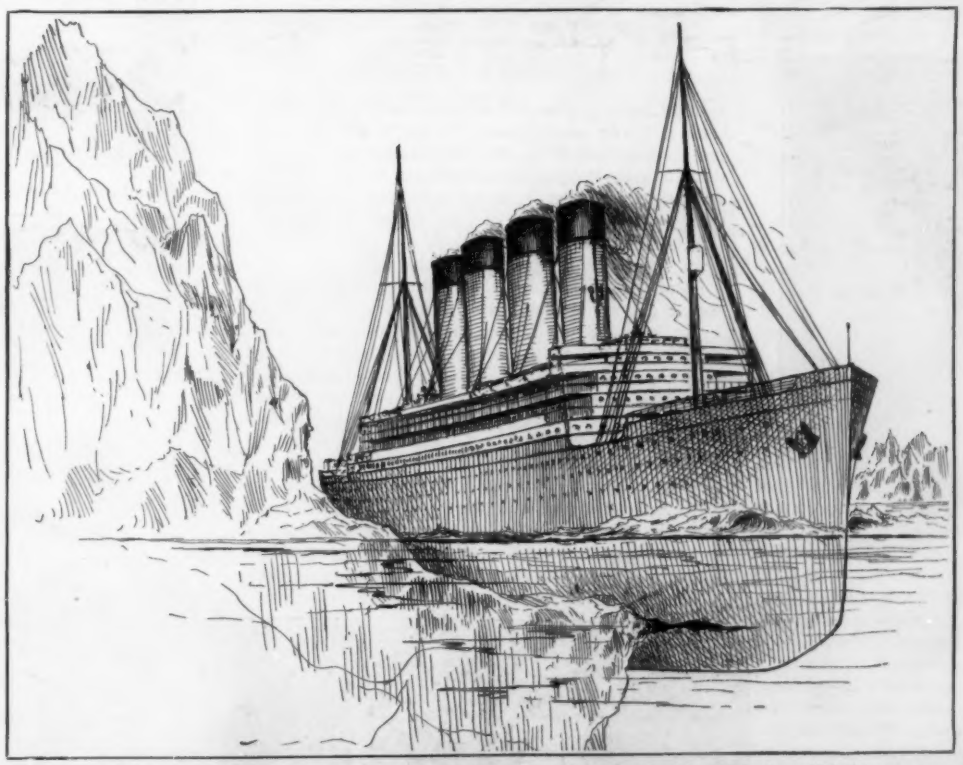
* * * * * *

Light Out of Darkness.

Never, surely, in all the annals of human heroism, was there written a chapter at once so harrowing and inspiring as that which was gathered by the press from the pitiful remnant of that night of sacrificial horror. We turn from its heart-rending story with a new sense of the God-like within us, and an exultant faith in the eternal uplift of the human race.

How the Great Ship Went Down.

Piecing together what the survivors witnessed from the boats, it is easy to understand the successive events of the ship's final plunge. The filling of the forward compartments brought her down by the head, and, gradually, to an almost vertical position. Here she hung awhile, stern high in air, like a huge, weighted spar buoy. As she swung to the perpendicular, her heavy engines and boilers, tearing loose from their foundations, crashed forward (downward); and, the water pressure increasing as she sank, burst in the so far intact after compartments. It was the muffled roar of this "death rattle" of the dying ship that caused some survivors to tell of bursting boilers and a hull broken apart. The shell of the ship, except for the injuries received in the collision, went to the bottom intact. When the after compartments finally gave way, the stricken vessel, weighted with the mass of engine and boiler-room wreckage at her forward end, sank, to bury herself, bows down, in the soft ooze of the Atlantic bottom, two miles below. There, for aught we know, she may at this moment be standing, with several hundred feet of her rising sheer above the ocean floor, a sublime memorial shaft to the sixteen hundred hapless souls who perished in this unspeakable tragedy!



In all probability a massive, projecting, underwater shelf of the iceberg with which she collided tore open several compartments of the "Titanic," the rent extending from near the bow to amidships. The energy of the blow, 1,161,000 foot-tons, was equal to that of the combined broadsides of the "Delaware" and "North Dakota."

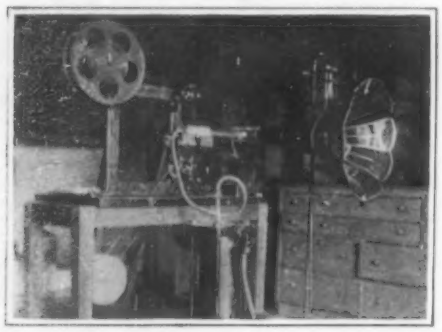
A New Phonograph

A Machine that Works on an Entirely New Principle

By the Paris Correspondent of the Scientific American

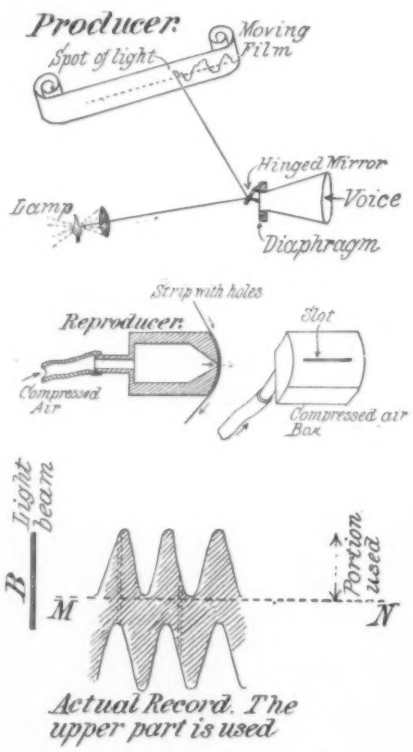
ALTHOUGH the invention of the phonograph dates now a good number of years back, and the instrument has come to be something of a household chattel, the results obtained are very far from being perfect, and in fact it may truthfully be said that within the last few years practically no progress has been made in perfecting the tone quality produced. A good deal has been done toward increasing the volume, perfecting the methods of preparing records, developing copying processes for multiplying records, and so on. But the complete elimination of all grating sounds, and the preservation of the natural proportion of the harmonics in the sound wave, these and other points, by the proper attention to which alone we can hope to attain a truly perfect rendering of the original sounds, have not hitherto been worked out with any very high degree of success. There is, therefore, a great deal of scope for further work of improvement. There seems to be no reason why the instrument should not be made so perfect that its reproductions could hardly be distinguished from the natural sound. Many inventors have been devoting their attention to this field. Perhaps the comparative unsuccess of their endeavors in the direction indicated above may be ascribed to the fact that they with few exceptions follow the beaten track and prepare their records by making an impression on wax or some similar composition, by means of a point or stylus, which follows the motions of the receiving diaphragm.

It seems probable that the most promising new developments must be looked for in some kind of a photographic method, in which the sound waves are recorded by a moving beam of light. Thus if we have a mirror attached to a diaphragm and speak against this latter, while a beam of light reflected from the mirror is allowed to fall on a screen, the spot of light will trace upon the screen a path determined by the character of the sound wave. If the screen is made of a sensitized photographic film rapidly drawn



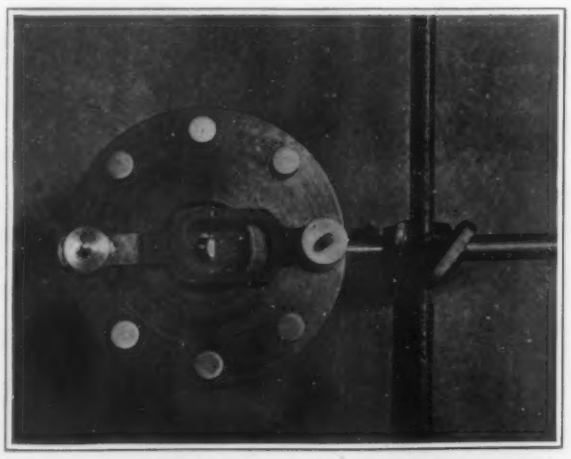
The reproducer.

past the field of illumination, a continuous record of the sound vibrations can be prepared in this way. So far the process presents no particular difficulties. The main problem arises when we seek to employ such record to reproduce the sounds by which it was formed, so that the apparatus constitutes, as it were, an optical phonograph. It is at this point that the ingenuity of a Russian scientist has stepped in with what appears to be a very promising mode of attack of a difficult problem. Mr. S. Lifschitz has succeeded in reproducing by his method the sound of the human voice. He began his experiments in Russia and subsequently continued them at the University of Paris, where, in collaboration with M. Victor Henri, he has worked out the ingenious apparatus illustrated in our engravings. This device, which was presented before the Academy of Sciences a short while ago, consists of a photographic recording device of the nature indicated above, and a separate instrument for reproducing the sounds. Both parts of the apparatus represent entirely new departures, the first working entirely by the photographic method, and the second making use of currents of compressed air to produce the imitation of the human voice. In the recorder any suitable membrane properly mounted to act as a diaphragm, for instance a telephone diaphragm, may be used. A minute mirror is attached to the back of this, so that when the mouthpiece is spoken into, the mirror is set vibrating. The light of an arc lamp is thrown in a concentrated beam upon the mirror, and is thence reflected on to a screen, so that the spot of light performs upon the screen oscillations representing on an enlarged scale those of the diaphragm. The screen itself consists of a sensitized film such as in



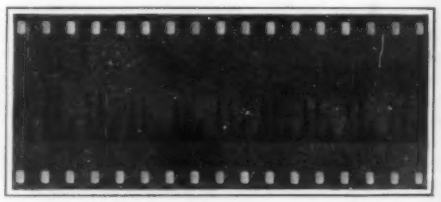
Principle of the new phonograph.

used in moving picture machines, so that when this band is drawn along rapidly in the field of the moving spot, a record is obtained of the sound vibrations impressed upon the diaphragm by the speaker. As a matter of fact, it is not a spot of light that is used, but a narrow line of light formed by transmitting the beam through a suitable slit in front of the lamp. The resulting record is therefore not a simple line, but a wavy band having a certain width, as shown diagrammatically in one of our illustrations. In applying this record for purposes of reproduction, only a portion of it is used, namely, the toothed upper edge of the band. More in detail, the mode of procedure is as follows: On developing the moving picture film a photographic negative is obtained. From this a positive copy is prepared on a film of gelatine treated with bichromate, all but the upper serrated edge of the band being blocked out in the usual way. The result of this operation, on developing the gelatine film, is a band perforated with a series of openings corresponding in size and arrangement to the peaks of the wave record, as shown in one of our accompanying illustrations. To use this record for reproduction, it is passed across an air jet, whereby a series of puffs is produced, varying in character and frequency according to the form of the record. For this purpose the reproducing apparatus is fitted with an air chamber fed with compressed air from a reservoir. This chamber is provided with a slit, the length of which is such as to accommodate the maximum amplitude of the serration marks upon the perforated band. The record band is mounted upon rollers above and below the air chamber and is driven by a small electric motor at the rate of about six feet per second across the slit. As the perforations in the band pass the slit, they give a vent to the air in the air chamber, thus producing a series of impulses and giving rise to sound waves corresponding in pitch and character to those by which the record was prepared. It has been found by experiment that in this way a very fair reproduction of the human voice can be obtained. The invention is, however, still in its early experimental stages, and a good deal of work remains to be done in improving the apparatus. The method is quite novel and very interesting, opening up new possibilities in a direction in which the resources of the common type of phonograph seem to be well nigh exhausted. Judging from the preliminary experiments, there seems to be every promise of important future developments, and we shall await with interest the further growth of this new invention. It might be mentioned that M. Dastre, one of the leading scientists connected with the Physiological Department of the University of Paris, in presenting the apparatus before the French Academy, expressed his conviction that the new device was destined in the future to surpass the performances of the existing forms of phonograph in perfection of rendering the human voice and other sounds.

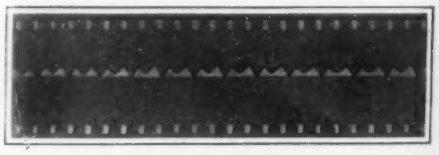


The recorder. At the center is seen the diaphragm carrying a small mirror.

THE NEW OPTICAL PHONOGRAPH



Light record (negative) of the vowel "u."



Light record of vowel "e." Perforated positive formed on bichromate-gelatine film.

The Gyro-compass in the Navy

BY invitation of the superintendent of the Naval Observatory, the scientific public in Washington has recently had the opportunity of inspecting a gyroscopic compass in operation. An American-made instrument has been adopted for use in the United States navy, and three ships have already been thus equipped. This ingenious substitute for the magnetic compass has often been described in the scientific journals; but probably few of our readers are aware of the position it is expected to occupy, in the immediate future, in the scheme of naval equipment. There is no present intention of adopting the gyro-compass for the ordinary purposes of navigation, although this may come in time. The great advantage that it offers, even in the present early stage of its development, is the fact that it can be installed inside the hull of a metal ship, where it will be protected from shot and shell during battle; while the magnetic compass would be useless in such a position. Although the gyro-compass itself is to be placed below-decks, with steering-gear at hand for use when necessity compels, it will be connected electrically with a number of dials (known as "repeaters") in other parts of the ship, by which the helmsman may lay his course until the stress of battle forces him to the more sheltered gyroscope.

The Laboratory

Some Suggestions for Home Experiment

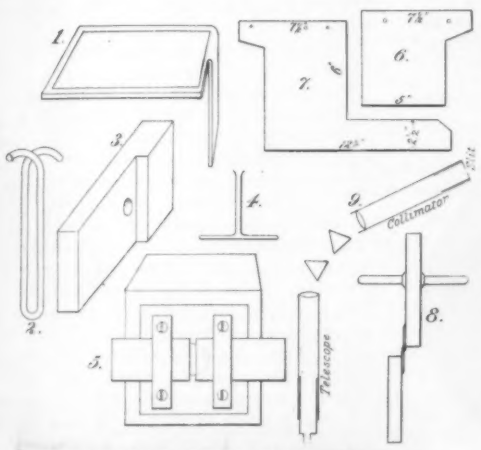
A Home-made Spectrometer

By C. C. Kiplinger

THE spectrometer is truly a philosopher's instrument. It aids us in the study of radiation of various wave lengths; it indicates the qualitative nature of chemical compounds; it illustrates refraction and affords a means of determining the refractive indices of many substances. In short, it is invaluable for both practical use and theoretical research.

The instrument herewith illustrated is simple in design and efficient in action. The stand comprises two pieces of well seasoned board not less than one inch thick, of the dimensions and shapes as shown in Figs. 6 and 7. The smaller board is the telescope support, which is attached to the larger, or L-shaped piece, with two rather heavy hinges, as shown in Fig. 8, and also in the photograph.

The method of attaching the hinges permits of swinging the telescope arm through an angle of one hundred

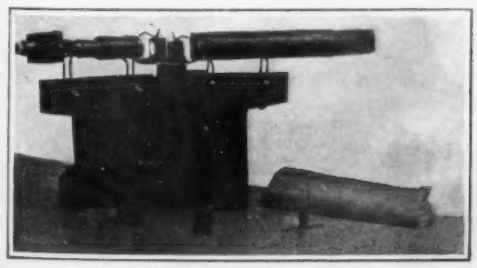


Constructional details of the spectroscope.

and eighty degrees. Care should be taken to get the hinges vertical and in line. Two iron shelf brackets screwed to the stand, serve to hold it upright.

The prism table consists of a piece of heavy sheet metal cut and bent as in Fig. 1. The top is covered with felt which is held in place by shellac. The table is held in place on the stand with a bolt and wood clamp (Fig. 3 and photograph) which renders it easily adjustable.

Fig. 2 shows the shape of the supports for the telescope and collimator which are made of heavy wire not less than one-eighth inch thick. The supports are held to the stand with bolts, and iron and cork washers. The cork washers permit of a firm yet elastic grip



Inexpensive home-made spectroscope.

on the wires and permit of their easy adjustment. Rubber bands snapped over the curved arms and the telescope and collimator tubes, hold the latter firmly to the wire supports.

In the design of the slit, ease of construction, of adjustment, and of cleaning were the chief ends sought. It is illustrated in Fig. 5 and is composed of a block of hard wood 1½ inches square with a ⅝-inch hole through its center. A square piece of 1/16-inch sheet metal with a 3/16-inch hole in its center and two strips of metal are held, as shown, by four ½-inch wood screws. Two pieces of watch spring with their adjacent ends chisel-beveled, are forced between the strips and the metal square. These form the jaws of the slit. The bevel should face the collimating lens so that the rays of light may spread. The adjustment of this slit is not as difficult a matter as some may think, it being very easy to bring the jaws near enough together to show the Fraunhofer lines distinctly. The jaws may be removed in a moment for cleaning and sharpening.

The optical equipment, although somewhat crude, will give much satisfaction. The lenses are of the partially corrected auxiliary enlargement type 1¼-inch size, used to supplement camera lenses, and may be obtained from any mail order house for about forty cents apiece. They come mounted in adjustable brass flanges and are hence very convenient for many optical purposes. One is required for the collimating lens and one for the telescope objective.

A positive eyepiece is used for the telescope. The prisms are short lengths cut from a long glass prism, three-fourths inch face, to be found in any laboratory and costing not more than fifty cents. It is very possible that hanging lamp prisms may be obtained of sufficient size for this purpose. When the spectrometer is used as a spectroscope two prisms should be used in order to get sufficient dispersion. The faces not in optical use should be blackened with lampblack and shellac varnish, leaving a clear space on two faces of each prism three-fourths inch in diameter. The prisms are held firmly in place on the table by large clips of spring wire.

The telescope and collimator tubes may be made of paper or metal and should be in two or more sections for focusing purposes. Any small telescope, power about ten, may be used by removing all the lenses in the eyepiece and substituting a positive eyepiece, or a double convex lens of short focus. Paper tubes are of advantage in working with spark spectra as all danger of the operator's receiving a severe shock from the metal work of the instrument is obviated.

A metallic protractor should be attached to the stand below the telescope arm, so that the angle through which the arm swings may be noted. The instrument is assembled and the prisms adjusted to their minimum deviation angles (Fig. 9). A suitable support for a diffraction grating may be made of a ½-inch metal strip, as shown in Fig. 4 and in the photograph.

A long glass prism can be cut in two or more pieces by filing a ⅛-inch groove all around it with a new file, using water as an aid to the cutting process and then carefully subjecting it to a sufficient breaking stress. The simple micrometer described in the SCIENTIFIC AMERICAN of December 16th, 1911, may be used to definitely locate spectral lines and to estimate wave lengths. Otherwise, a hairline should be used in the eyepiece.

A Bell-ringing Transformer

By Frederick E. Ward

THE electric doorbell is without doubt one of the simplest and most satisfactory of modern electrical conveniences, the only really weak link in its chain being the battery, which it is a continual nuisance to replace or renew and which gives warning of needed attention only by complete failure to perform its function. In homes that are supplied with alternating current for lighting purposes, however, battery troubles can be easily eliminated by installing a small transformer to ring the bells. Such a transformer, if made as described below, will serve not only for this purpose but also for operating short telegraph lines, miniature lamps, electric toys of the kind having series-wound motors, and for Christmas-tree lighting. When once properly made and installed this piece of apparatus will operate for a lifetime without attention and at but little expense for the energy it consumes.

The transformer shown in the drawing and photographs is of the type known as the "hedgehog," and consists simply of two coils of insulated copper wire wound one on top of the other on a spool, through the center of which passes a bundle of bare iron wires.

The dimensions of a suitable spool upon which to wind the coils are given in the drawing in Fig. 1. The spool is best made in the lathe by turning it out of a solid piece of hard wood, but a good one can be made by gluing two wooden heads on a tube formed by wrapping several layers of stiff paper around a ¾-inch rod.

For lighting circuits of about 110 volts, 60 cycles, the primary coil should be wound with 4,800 turns of No. 28 wire, which will weigh about one pound. One of the best kinds of insulated wire for this purpose is that having a covering of enamel protected by one of cotton. Wind the wire in smooth, even layers like thread on a spool, passing the ends out through holes in one head.

The secondary coil is to be wound on top of the primary coil, the latter being first covered with two layers of oiled muslin, or of cotton cloth tied down with thread. For eight volts there will be needed in the secondary coil 400 turns of No. 18 double cotton covered magnet wire, of which about 1⅜ pounds will be required. This is most conveniently put on in eight layers of fifty turns each, which allows of a loop, or tap, being brought out at the end of the fourth layer, or middle of the coil, from which four volts may be obtained by connection to it and to either one of the coil ends. Fig. 2 shows the primary with its two fine wire terminals sticking out through the head, and the white secondary coil on top with its three connections.

For the core of the transformer about three-fourths pound of No. 20, or finer, soft annealed iron wire is required, cut in pieces about 10½ inches long, and carefully straightened. The ¾-inch hole through the coils should be packed with as many of the pieces of the wire as it will hold. This is also shown in Fig. 2, together with a part of a necessary covering of cotton tape for the protection of the secondary coil.

The next step in the construction is to bend the ends of the iron wires around as shown in Fig. 3, so that they overlap and completely inclose the coils except

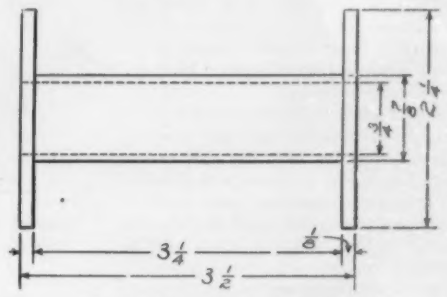


Fig. 1.—Dimensions of the spool.

for a small space where the coil ends come out. The iron wire ends must be drawn down in place and bound with several wrappings of twine as shown.

The terminals of the primary coil are so delicate that they are always liable to be broken off, thus spoiling the entire apparatus. To guard against this mishap it is advisable to bind a piece of lamp cord to the core in the position shown in Fig. 3, and afterward to solder the ends of the primary wires to this cord, thus relieving them of all strain.

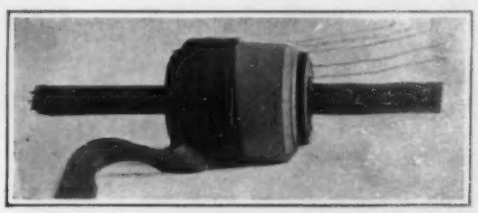


Fig. 2.—Wrapping the secondary.

Fig. 3.—The transformer completed.

To protect the transformer from dampness and from mechanical injury it is a good plan to warm it slightly in an oven, place it upright in a suitable glass jar, and pour in enough melted paraffine to cover the core and soldered connections.

The lamp cord terminals are to be permanently connected to the 110-volt alternating current mains, while the secondary terminals go to the bell circuit in place of the battery wires. Bells of ordinary size will ring well on four volts, obtained from one secondary terminal and the middle loop, while for those that are larger, or on longer lines, eight volts is available from the two outside terminals. For Christmas-tree lighting with a dozen 3½-volt battery-lamps, connect one-half of the lamps to each half of the transformer secondary.

During the long periods that the transformer is idle it draws only about 1¼ watts from the power supply. This load alone is too small to actuate the ordinary meter, so that the latter registers nothing for the transformer losses except at such hours of the day as current is being drawn for other purposes also. On the basis of current being used for house lighting an average of four hours a day, with nothing but the ringing transformer in circuit during the other twenty hours, the transformer losses will be but 20 cents a year.

What Inventors Are Doing

Simple Patent Law; Patent Office News; Inventions New and Interesting

The Rotary Gear Pump—An Early Patent

By Guy Hubbard

OF late, considerable interest has been aroused upon the subject of early patents issued by the United States Government. This is due to the fact that the number of patents has reached one million. Hence it may be interesting to many to know about one of the earliest, and also a quite important patented device.

To-day the rotary gear pump holds an important place in the list of useful and important machines. It is well adapted to be driven by belt or direct shaft, it delivers a steady stream of large volume and is practically valveless.

When Asahel Hubbard, of Windsor, Vt., began to experiment upon an improved form of pump, in 1825, he was seeking these advantages. Hubbard was a skillful and ingenious machinist, who had the energy and ability to work out his idea and put it into practical form. He believed that rotary motion would ultimately supersede reciprocating motion in many forms of machinery. The truth of his theory is proven to-day in many ways.

Hubbard looked upon the pump as a good example of a machine which could be improved by such a change of form, so he began to experiment along that line. The pumps of that time were very crude and the machinery at his command was of the simplest kind, so the work of designing and building a model was very difficult.

Nevertheless, by 1828 he had designed an almost perfect form of rotary pump which embodied all the advantages desired. The writer possesses several of the original models and they are excellent machines. The pump consists of a hollow cylinder of cast iron, about seven inches in diameter and six inches deep, two iron heads, which bolt on to the ends of this cylinder, two gears and a crank. The inside of the cylinder is rough except for two curved surfaces on the opposite sides. These surfaces are accurately ground, so that the buckets or teeth of the gears will just brush them.

The gears themselves are of curious shape and are most accurately formed. Unlike a common gear, the teeth are curved, thus forming buckets. The heads of the cylinder are fitted with accurately placed bearings, which hold these gears in place. One of these bearings is fitted as a stuffing box through which the shaft of a gear passes. The pump is driven by a crank upon this shaft.

When the pump is set in motion one gear drives the other. There is an inlet pipe in the bottom below the gears and an outlet above. The water in the lower part is scooped up by the buckets and carried between the curved surfaces and the buckets into the upper part. It cannot go back between the gears, as they interlock, forming a water-tight joint.

This sounds like a good theory, but it seems very impractical. The writer was very doubtful himself until he put one of the old pumps into working order. A surprise awaited him. This old-time pump, with all its sliding joints, would forcibly pump air, in fact it was almost impossible to turn the crank when the outlet pipe was closed. One would now be led to think that the friction must have been great. On the contrary it is very slight. The pump may be revolved by the force of the breath. In fact, the pump can be used as a very simple and efficient rotary steam engine, as the writer has since done. Such accuracy in design and workmanship is quite wonderful for the period and conditions under which the work was done. The lathe work was done on a simple speed lathe with hand tools.

In 1828 Hubbard applied for a patent. One of the pumps was sent to Washington and was examined by the President, Secretary of State, and Attorney-General. They pronounced it a most ingenious and deserving invention and a broad and binding patent was granted.

This document itself is of some historical interest. It is composed of two sheets of parchment bound like a newspaper and is about as large as the SCIENTIFIC AMERICAN. On the front is the official declaration concerning the patent granted. This is dated April 22nd, 1828, and bears a large United States seal. The document bears the personal signatures of J. Q. Adams, President of the United States; Henry Clay, Secretary of State; and William Wirt, Attorney-General. Patents must have been few indeed in those days if those officials found time to personally sign them. The other sheet is taken up with a very clear and truly scientific explanation of the machine, written by the inventor. In the patent the pump is called a revolving "hydraulic engine."

This pump was for many years manufactured at Windsor and proved a success. The old-time machine shop still stands and looks as it did eighty-three years ago.

When the term of the patent expired several companies began to build these pumps, and they continue to build them at the present day. It is interesting to note that the rotary gear pump of to-day does not differ materially, and certainly gives no better results, than the original Hubbard pump of eighty years ago.

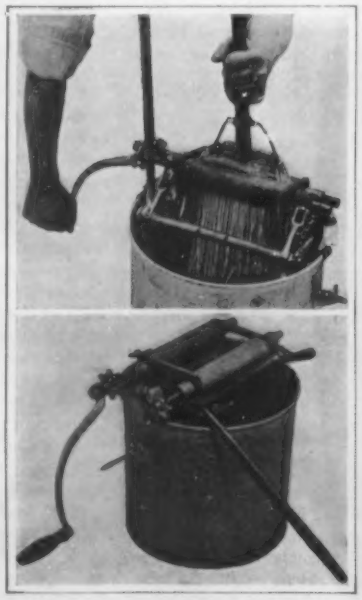
These facts stand out as proof of the uncommon skill and ingenuity of this forgotten inventor back in the early years of our Patent Office.

Asahel Hubbard, inventor of a rotary gear pump patented in 1828.

The several parts of the pump, on left, and, on right, the pump assembled.

Pump case with one of the bucket cylinders removed and shown separately.

The pump case open, showing the rotary scoops or buckets.



Detail views of the wringer.

The wringer in use.

New Mop Wringing Device

A NEW device for the dry wringing of mops, clothing, etc., but especially adapted for quick service in large office and other public buildings, is just now daily demonstrating its great labor and time saving qualities at the Museum of Natural History, New York, where the machine has been invented and constructed. Every morning an area of ten acres, or a highway equal to twenty-five city blocks, sixty feet wide, about one and a quarter miles long, is thoroughly cleaned by a squad of twenty men and four wringers in two hours. Previously under the old methods the same men consumed nearly half a day in going over and mopping up this same floor space. The wringer is also adapted for dyers and large sea-shore bathing houses. Mr. H. Bears is the inventor and patentee of the machine.

The wringer is attached to the tub, bucket or other vessel by means of a frame, provided with clamping devices. A main roller is mounted on this frame with slotted link members on each end, carrying a supplementary roller, movable toward and away from the main or fixed roller. Downwardly directed, yoke-shaped springs, comprising longer and shorter arms, are attached to the ends of the transverse member of the frame by the longer arms, which also form the bearings of the main roller. Link-shaped devices are pivoted to the shorter arms and support the supplementary roller. A shaft running parallel to the main roller is provided with anti-friction roller cams, operated by a lever. By moving the lever forward the supplemental roller is also moved forward, leaving a wide space between the rollers. The mop to be wrung is passed down between these rollers, after which the lever is raised and moved backwardly, forcing the supplemental roller by means of the roller cams into contact with the main roller. The roller cams, being forced into their seats, securely lock the supplemental roller in position. The ends of the rollers being fitted with spur gears, are now in mesh; and by means of a crank attached to the main roller, the mop is drawn upwardly through or between the rollers and thoroughly wrung out, all water or watery substances being pressed out of it into the vessel below. This process of wringing or drying a mop is absolutely sanitary, there being no necessity of coming in contact with the mop or polluted water with the hands or clothing.

Prizes for Inventors

MANY of the miscellaneous prize offerings of the present time are regarded by many as mere clap trap. It is not intended thus to classify the well-directed prize offerings especially made for the production of some desired or specified thing, whether machine, tool, or product; but rather indiscriminate prize offerings for so-called meritorious inventions without regard to purpose.

It is however a fact, that probably the original promoter of the idea of giving prizes for inventions was no less than a Commissioner of Patents and a man whose views as an able official and the author of a remarkable book, in its way, "Ewbank's Hydraulics and Mechanics," should be entitled to consideration. He proposed that the prizes should be offered by the United States Government and awarded by its duly credited officials. Thus in his report as Commissioner of Patents in 1850 Thomas Ewbank suggests that $100,000 of the Patent Fund be held sacred and intact as a "permanent Inventors' Premium Fund from the interest of which rewards in money may be distributed one every four

years, for the most important addition to science and the useful arts."

He also suggested plans to carry out the awards and referred to the wise custom of old to strike medals in bronze of remarkable men and proposed the preparation of three sets of dies in bronze or other metal-producing medallions of Franklin, Fulton and Whitney to serve as prizes and accompaniments of prizes for valuable contributions to mechanical science. It is significant that at that early period, 1850, he advised the award of a prize to the one who should "render electricity in any of its forms an economical, efficient and general prime mover."

Proposed Patent Legislation

A BILL, House Bill No. 23,193, has been introduced in the House of Representatives, a similar bill in the Senate, entitled a bill to codify, revise and amend the laws relating to patents.

The bill as introduced makes many minor changes in the law and some of much importance which should be carefully considered and given much thought before they are enacted into law.

By the bill it is proposed to constitute a Board of Appeals consisting of the Commissioner of Patents, the two Assistant Commissioners and the Examiners-in-Chief, any three of whom shall constitute a quorum. A patent bar is also provided as well as a registration fee of $5 and annual dues of $1 for representing patent clients before the Patent Office, which may be employed in defraying the expenses of examining applicants for admission and for such investigations as may be necessary. The money remaining is to be paid into the treasury and added to the accumulations already collected from the army of inventors. To secure a proper standard of advertising matter all registered attorneys are required to file with the Commissioner of Patents not less than thirty days before the same are issued for general circulation, copies of all advertising matter framed to solicit business or to secure sale of patents and violation of this may cause suspension or disbarment of the attorney.

While it is provided that the patent shall contain a grant "for the term of seventeen years, every patent shall be so limited as to expire nineteen years from the date of filing the application exclusive of the time consumed by the Patent Office, Courts and in interference."

A compulsory license provision is included in the bill granting a right of appeal to the Circuit Court of Appeals from the granting or refusing to grant such license. Applicants for patents or reissues, who are not domiciled in the United States, must designate by a notice in writing, filed in the Patent Office, some person residing in the United States on whom process or notice of proceedings may be served with full effect.

The time for prosecuting a patent application is reduced from one year to six months after an official action.

The act reverses the fees making the filing fee of applications for patent $20 instead of $15 and the final fee $15 instead of $20 as at present. At first glance this appears to be the same thing but many applications for patent for one reason or another do not eventuate in the issue of patents, so that a considerable additional revenue should result.

The bill was introduced in the House by Chairman Oldfield of the Committee on Patents and was referred to his committee, which will doubtless arrange for hearings at which those interested may appear and discuss the merits and demerits of the proposed law from various points of view. Mr. Oldfield has also introduced a bill seeking to make it unlawful to insert a condition in any contract relating to the sale, lease, or license to use any article or process protected by a patent or patents, the effect of which will be to require the purchaser, lessee or licensee to acquire from the seller, lessor, or licensor or his nominees, any article or class of articles not protected by the patent, and to nullify any such condition as being in restraint of trade and contrary to public policy. The SCIENTIFIC AMERICAN will discuss the bill editorially at the proper time.

Notes for Inventors

Catches and Electrocutes Rats.—A trap which catches the rat and kills him by an electrical shock is shown in patent 1,012,351 to Marion Gold of New York city. The trap has a receptacle and a pair of spaced apart electrodes forming part of a broken circuit and a passage way leading to the electrodes, which form substantially continuations of the walls of the passage way. Mr. Rat closes the circuit, is electrocuted, and one of the electrodes is movable to deposit the electrocuted rat in a receptacle.

Gum Drops as Ear Stoppers.—Some weeks ago the SCIENTIFIC AMERICAN illustrated a small device intended to be worn in the ears to prevent injury from nearby explosions of heavy ordnance. This recalls a simple expedient adopted by an old Patent Office official to protect himself from unusual noises, even from the ordinary noises incident to the usual transaction of business, as he suffered from extreme nervousness. He told the writer that he obtained great relief from ordinary gum drops, the boon of Arctic explorers. He did not take them internally as a whole, but after sucking the sugar from the drops would stick one in each ear and declared that they afforded him a perfect relief from the disagreeable noises.

Can Distortion in Map-printing be Avoided?—Most navigating charts are produced from engraved plates and usually to scale. In printing the paper is dampened and applied to the plate and the imprint is therefore on a damp sheet of paper. When this dries it shrinks to a considerable degree thus producing a distortion of the chart. The shrinkage varies so that it is not possible to avoid distortion by allowance in engraving the plate. The problem is to avoid the distortion in printing.

Disadvantages of High-pressure Water Service.—If you live in a city or district where the water service is high pressure, you have doubtless experienced washer troubles at your faucets. A friend claims his plumbing expenses have materially increased since high pressure was installed and wants to know why faucets cannot be devised whose packing will not cut out and leak in a few weeks under high pressure service.

A Live-lobster Package.—Fred B. Higgins of Boothbay Harbor, Maine, has patented (No. 1,016,627) a shipping package for lobsters, in which a suitable barrel-like container has a central tapered core of ice and lobsters are arranged in layers surrounding the core with a suitable packing between the superposed layers, so that, as the ice core melts and diminishes, and the layers of lobsters settle, the lobsters will continue to be held snugly against relative movement.

The Government Wants Good Ink.—A Government official says he would like to have a writing ink that will not corrode the pen almost as soon as used and will not clog on the pen point. Doubtless many commercial inks will be claimed to fulfill these requirements.

The Tire Armored by Electro-deposited Metal.—The tire patented by Victor A. Rouilliard of Fall River Mass., and his assignee of one-half, Armel L. Audet, of the same place, is made with one or more layers and a protecting metallic coat electro-deposited on one of them.

An Illuminated Dancer's Dress.—Stage effects are secured sometimes by scenery, at others by costumes and lights and sometimes by combinations. A dancer's dress is shown in patent No. 1,022,433 to A. L. McMurtry of Sound Beach, Conn., the garment being of opaque material and electric lamps being disposed in a number of series within the garment. All the lamps in one series are of one color and those of the different series of different colors and in circuits and a manually controlled switch enables the dancer to switch on the lamps of any series at will.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

REDUCING CORSET.—H. JACOBS, Box 60 Station O., Brooklyn, N. Y. In this patent the invention relates to a new and improved form of reducing corset, and an object of this invention is to provide a corset of any well-known construction so arranged and constructed as to permit a perspiring process to reduce obesity.

STOCKING.—M. A. HEYDE, care of S. E. Summerfield, 305 E. 103rd Street, Brooklyn, New York, N. Y. This invention refers to knitted tubular fabrics, and its object is to provide a new and improved stocking, arranged to prevent it from ripping open throughout its length in case one or more stitches break in the upper portion.

REVERSIBLE CUFF.—N. P. SHULIN, Box 1265, Butte, Mont. This invention relates particularly to means for reversing the lower edges of the legs or sleeves of garments to produce a turn-up or cuff effect, and also to produce a turn-down or normal effect. An object is to provide a garment which shall have the bottom portion thereof present the same external surface and neatly bound edges when turned up on the exterior thereof, as well as when in plane turn-down condition.

TROUSERS HANGER.—G. R. BOWMAN, 528 Union Street, Rockford, Ill. This invention has reference to improvements in hangers for trousers, and the object is to provide a device which is simple, cheap and efficient to permit trousers to be quickly and conveniently hung up to stretch and which will permit of the ready release of the same.

Of Interest to Farmers.

INSECT DESTROYING APPARATUS.—D. C. MCCROSKEY, North Birmingham,, Ala. In this patent the invention is a fumigating apparatus designed for the purpose of destroying insects and other pests which thrive amid growing grain and damage the crops; and it comprises novel means for generating and distributing fumes in the places where grain is grown.

Of General Interest.

FENCE WIRE STRETCHER.—W. F. GOOLSBY, Livingston, Tenn. This invention involves a stretcher for use with fence wire, and is particularly directed to an implement which consists of few parts and which may be produced at a low cost, the construction and arrangement of the parts being such that the device is capable of rapid work.

DEPOSITORY AND ACCOUNTING DEVICE.—F. M. WHALLON, 767 Prospect Avenue, Buffalo, N. Y. For the purpose of this invention, use is made of a casing provided with means for removably securing a plurality of books having accounting means thereon and adapted to contain sheets of stamps and the like, and means for removing the sheets from the books or exposing a portion of a sheet when it is desired to use the same.

SATCHEL LOCK.—D. MORGENSTERN and M. BRILL, 465 Broome St., New York, N. Y. This invention pertains to locks and particularly to locks for satchels, bags, pocketbooks and the like, and the object is the arrangement of an improved structure designed to co-act with the ordinary lock of a satchel for preventing accidental loosening or unfastening of the same.

COMPENSATING STEERING GEAR.—E. T. REICHERT, JR., care of Republican Club, 54 West 40th St., New York, N. Y. In this case the invention has reference to improvements in steering gears, and the object thereof is to increase the leverage on the rudder and thereby to decrease the strain on the tiller ropes, when the rudder is swung from central position to either side of the vessel to which it is attached.

SANITARY CISTERN.—J. A. LEIGHTON, P. O. Box 14, Estherwood, La. An object here is to provide a cistern which is continually covered when it is not raining, but which may be open to admit water automatically by the rainfall. The covered cistern has means for carrying off any particles of dirt or of foreign matter which may have found their way into the cistern with the water and for drawing off from the cistern pure filtered water.

Hardware and Tools.

PERMUTATION LOCK.—T. H. HART, 563 Rutherford Ave., Charlestown, Mass. This improvement provides a lock, arranged to permit the user having the combination to readily unlock the door on the outside without the use of a key, to prevent an unauthorized person from opening the lock, and to permit ready application of the device to door locks, as now generally used.

DRAWING INSTRUMENT.—T. H. MCANELLY, Louisville, Col. This instrument combines a protractor, compass and measuring stick or straight edge for use of mechanics, instructors and other persons, and especially serviceable for use in schools when making drawings in geometry, physics and the like on a blackboard, the drawing instrument being simple, and capable of being readily folded into a small space or extended for drawing straight lines, angles, circles, etc.

Heating and Lighting.

BURNER.—HARVEY W. GARDNER, care of Gardner Oil Burner Mfg. Co., 307 East 10th Street, Kansas City, Mo. It is with the object of providing a fine adjustment of the relative quantities of air, oil vapor or gas and steam that Mr. Gardner has invented the burner here referred to. It consists of three concentric tubular members, and each terminating in a conical nozzle. Each tube is provided with shoulders, to close the annular chambers formed between the tubes. The outer barrel of the burner is provided with three inlet pipes, respectively communicating with the three fluid chambers. The innermost chamber is supplied with air; the next chamber with oil or gas and the third with steam. The conical passage at the nozzles of the two outer chambers may be contracted or expanded to regulate the flow of steam and oil vapor by adjusting the tubes axially.

LAMP CHIMNEY.—Y. K. BUELL, 355 W. 50th St., Manhattan, New York, N. Y. This invention has reference to lamp chimneys, and particularly to the type of lamp chimney that is used in connection with mantle burners. The object of the improvement is to produce a lamp chimney having means for regulating the draft at the upper and the lower ends thereof.

Household Utilities.

CONVERTIBLE BED AND DIVAN.—W. THOMPSON, 124 Atlantic Ave., Brooklyn, New York, N. Y. For the purpose of converting the bed into a divan and vice versa, use is made of a middle bed section and two end bed sections, of which the middle bed section is adapted to form the divan seat, and of said seat and sections one is pivoted on the middle bed section to swing upward for forming the back of the divan, and the other is mounted to slide forward or backward and under the middle bed section.

Machines and Mechanical Devices.

ADJUSTABLE PROPELLER.—F. Harlow, 25 St. Stephan Street, Boston, Mass. This invention comprehends more particularly an adjustable propeller suitable for use upon airships, flying machines and various other types of mechanism in which it is desirable that the operator, by a very simple movement, may be able to shift the axis of the propeller quickly and effectively from one angle to another.

COMBINED AEROPLANE AND DIRIGIBLE BALLOON.—W. E. Zells, 179 Drexel Avenue, P. O. Station 50, Detroit, Mich. The principal objects here are: to provide in a machine a flexible connection between the carrying frame and the air floated body; to provide an air floated body adapted to balance the weight of the carrying frame and load mounted thereon; to provide a harness for the floating body to maintain the shape or form thereof and to prevent chafing or wear upon the body thereof; and to provide planes and means for controlling the same to change vertical and horizontal disposition of the machine.

Pertaining to Vehicles.

ARMORED TIRE.—V. A ROUILLIARD, 54 Peckham Street, Fall River, Mass. The intention in this case is to provide an improved armor or protector for rubber, especially pneumatic, tires of automobiles, motor-cycles, and other motor-propelled vehicles, whereby they will be made practically puncture-proof and without materially increasing their thickness and weight and with but little addition to their cost.

VEHICLE WHEEL.—G. B. LAMBERT, 21 East 82nd Street, Manhattan, New York. This invention relates to vehicle wheels for use with pneumatic and other tires, and has reference more particularly to the combination of a wheel proper, a removable tire-carrying rim mounted thereon and fulcruming at two points of the circumference of the wheel, whereby the rim can be swung in opposite directions out of the plane of the wheel, means for swinging the rim, and wedging means between the wheel and the rim.

DEVICE FOR STARTING MOTOR CYCLES.—F. A. BURROWS, 1224 Elmwood Avenue, Columbia, S. C. An object of the invention is to provide a device by means of which the rear wheel of a motor-cycle may be lifted from the ground while the vehicle is at rest, and which is provided with a lever which may be pressed downwardly, thereby bringing the rear wheel into contact with the ground and at the same time giving the vehicle a forward impetus.

Designs.

DESIGN FOR A SHOE.—W. BERNSTEIN, Manhattan, New York. This design is of a lady's shoe, and the ornamental features outside of the exquisitely shaped shoe comprise a gracefully marked counter and top. At the bottom of the lacing is a buckle and over this is a nicely curved shield with attractive markings.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

A Substitute for Pencil Cedar

At a time when our principal pencil wood is practically exhausted, a discovery of another suitable wood tending to relieve this state of things is a boon difficult to overestimate. The properties of the native pencil cedar which includes the northern red cedar (*Juniperus virginiana*) and the southern form (*Juniperus barbadensis*) are so marked, and so different from those of other commercial woods that it seems almost hopeless to find a satisfactory substitute. Other native species of the genus *Juniperus* yield woods nearly similar to the regular pencil cedar, and they have all been tested for use in the pencil industry. While these woods have not given entire satisfaction a good deal of the available supply will eventually be used for making pencils.

There is no other wood-using industry in the United States so dependent upon a single species as the pencil industry is upon red cedar. The scarcity of the pencil material will soon be felt also in Europe. A single firm in Nürnburg, Germany, makes annually over 300,000,000 lead pencils out of the American cedar. About 100,000 tons, or 7,500,000 cubic feet, of wood are required for making these pencils. An equal amount is consumed annually in the United States in the pencil industry alone. This makes a total consumption of over 200,000 tons or about 1,500,000 cubic feet of wood annually, or a little over 600 tons of cedar wood are used for pencils each day in the year. How long the supply will last at this rate of consumption is difficult to say, but it is certain that unless a suitable substitute is introduced some of the mills now in operation must shut down inside a few years.

The requirements for wood used in the pencil industry are most rigid. The wood must be soft, light, strong, close and straight-grained, free from defects, and must not check and warp. The physical properties of cedar are subject to considerable variation due to soil and climatic conditions, and for this reason it must be carefully inspected and graded as to quality. The lightest and softest wood is produced on the swampy hammocks of Georgia and Florida. The older the tree the softer and better the wood becomes. The wood of the shell of rotten logs is said to be the best for making pencils. The hard flinty wood such as is obtained principally from trees on dry upland or near its western limit of distribution is considered a poor grade.

Pencil makers both in this country and abroad have long since been searching for a suitable wood to take the place of cedar, and an announcement has been made that a substitute was discovered in East Africa which may be obtained in sufficiently large quantities at a reasonable price. In Europe this announcement was accepted at its face value. In America the pencil makers prefer to wait, pending more exact information, for fear that this discovery may share the fate of many others which under the rigorous tests of quality, amount of available supply, and cost of production, have failed to realize the anticipations formed by them, or even to establish a claim to commercial value. There can be very little doubt, however, in the case of the wood from East Africa, because it is known to be a very good wood, and pencil makers in Europe have tested it and found it to be an excellent substitute for the American cedar.

The introduction of a new wood is usually very slow, and the promoters and exploiters of strange woods frequently score heavy losses, although the kinds they import are good and useful. This East African cedar is now being imported into Germany, and it is likely that it will soon be used in this country. The tree which yields this wood is very closely allied to our pencil cedar and is known botanically as *Juniperus procera*. It forms a beautiful tree from 75 to 125 feet in height and from 2 to 4 feet in diameter. Sclater, an English naturalist, states that in British East Africa the trees frequently attain a height of 200 feet and a diameter of 6 feet. East African cedar is distributed over the mountainous regions from Abyssinia southward into German East Africa, and is found in great abundance around Kilimandscharo. It is best adapted to a region at an elevation varying from 4,500 to 9,000 feet. In Usambra it forms open forests just above the meadow land. Farther inland, especially in the Kenia re-

gion, the cedar forms pure stands and is present in such an abundance that practically all travelers through this territory describe it as one of great promise for export after better transportation facilities are provided for within the cedar belt. That the wood is of great practical importance is well known to all who have made a study of German East African timbers. Schimper, in his book on plants of Abyssinia, remarks that it is one of the most valuable timbers for a great many purposes. It also contains and yields a very valuable resin.

Similar to our native cedar, the wood is soft, light, durable, easily worked, highly scented, of good color, uniform texture and fine grained. The annual rings of growth are indistinct to the unaided eye. The surface exposed by cutting the wood with a sharp knife is very smooth and has a satiny luster. These are facts which will place this wood on a par with the American pencil cedar, not only in the manufacture of lead pencils, but for other purposes requiring especially fine-grained and durable wood.

Blood as a Weapon of Defense

EVERYONE has been startled, on seizing a grasshopper, by having the animal throw off a quantity of "tobacco-juice" from its mouth. Many insects throw off quantities of juice in this manner when they are attacked, some from the mouth, some from the "joints" on the abdomen, some from special points on the head, or other parts of the body. The juice thus ejected is generally some of the insect's blood, and its sudden discharge no doubt frequently causes the captor to loosen his hold, or to drop the prey altogether. Especially is this likely in the case of those insects that emit an acrid or a poisonous liquid, as for example the "Spanish fly" or cantharides beetle. It is not to be supposed that this discharge is in any sense a voluntary act on the part of the insect; it is a direct response to certain kinds of disturbance. In this respect the action may be compared to "death-feigning" in insects and in other animals. In some insects, in which the juice is discharged from the soft parts of the abdominal segments, the juice is thrown off upon suitable stimulation even after the animal's head has been removed.

This curious behavior is not confined to any one family of insects, but has been observed among several species of the grasshopper family, among ants, wasps and hornets, in members of the moth and butterfly family, in beetles, in true bugs and even among certain flies. The blood does not come to the surface through wounds caused by the disturbance; the opening is produced by a sudden increase in blood pressure, at points that are especially thin and yielding. The first effect of the disturbance is to cause certain muscles to contract, thus increasing the pressure in the blood, leading to the bursting of the special ejection spots.

Artificial Snow in Skin Treatment

CARBON dioxid gas is one of the few gases that are easily converted into a liquid by the mere application of extreme pressure, at ordinary temperatures. The liquid carbon dioxid may now be purchased in most large cities, the material being delivered in strong metal flasks. For the treatment of various skin diseases a snow or solid rod of this substance has been successfully employed. On opening wide the valve of the tank, the liquid escapes rapidly into the air; as it evaporates, the temperature is greatly reduced —reaching as low as 110 degrees below zero, Fahrenheit. The result of this rapid cooling is that some of the escaping liquid about the valve is frozen to a snow. If the stream of escaping liquid is directed into a bag made of chamois skin, it is possible to obtain a mass of snow about the size of a hen's egg in from five to ten seconds. The snow is shaped into cylindrical rods or "pencils" by being pressed into wooden molds.

The application of the tip of one of these rods to the skin results in a freezing effect; the extent of the area acted upon, or the depth to which it reaches, may be completely controlled by the surgeon according to the needs of each case, since the pressure and the movements of the pencil determine how much is "frozen." The application lasts from one second to about a minute, according to the amount of tissue that is to be frozen. By this means many skin eruptions and blemishes have been successfully treated.

No one lubricating oil is best for all cars. This is absolute.

We will make it clear.

But, first, in the light of careless statements on lubrication, we will make plain our right to speak with authority.

UNDER its Gargoyle trade mark the Vacuum Oil Company supplies lubricants to—

The floating armament of the world's leading naval powers.

To leading ocean steamship companies throughout the world.

Outside of the American market, to over seventy foreign automobile manufacturers.

To practically every aeroplane in active use, both private machines and the military aeroplanes of the leading powers.

To leading manufacturing plants at home and in every quarter of the globe.

For over half a century we have made lubricants, not as by-products, nor as temporary profit makers, but as a serious business.

In power-engineering circles, our standing as the authoritative leaders in high-grade lubricants is unquestioned.

TURNING to automobile lubrication:

Carbon deposit, as a factor, is widely misunderstood.

Proper filtration will remove, from lubricating oils, the greater part of the free carbon. But lubricating oils are a hydro-carbon product.

In burning they must leave some residue.

The mount of carbon deposited in the cylinders depends partly on the carburetion and gasoline combustion, partly on the oil, partly on its fitness for the car.

The majority of cars, in using the oil best suited to them, get the greatest freedom from this annoyance.

But carbon deposit is generally a dangerous guide in choosing the correct lubricating oil for a particular car.

There is only one guide that is sound:

What oil yields the highest horse-power?

You may not care for speed. But, to safeguard your car, you do want its greatest horse-power efficiency.

Wasted horse-power results from restrained action—either from friction or some other injurious deterrent.

As oil saves power, it follows that one oil saves more power than another.

To get the highest horse-power from your car, you must use the lubricating oil best suited to it.

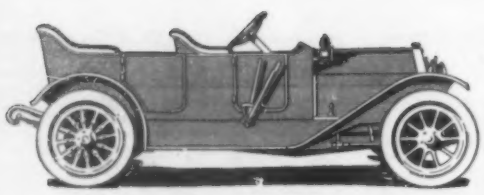
It is of the utmost importance that you use that oil and no other.

No one would think of using the same lubricant for a sewing machine and a battleship.

The needs of two motor cars often differ quite as widely.

The correct oil for a Fiat, for instance, is absolutely the wrong oil for a Packard.

The spring-strength of the piston rings must be considered; the fit of the piston ring into its recess; the length of the crank-shaft and connecting-rod bearings; the feed-systems; the length of the vacuum period, while intake and exhaust valves are both closed.



This list shows the right oil for your car

In the schedule, the letter opposite the car indicates the grade of Gargoyle Mobiloil that should be used. For example, "A" means "Gargoyle Mobiloil A." The meaning of the marks * † ‡ § is shown at the bottom of the page. For all electric vehicles use Gargoyle Mobiloil A. The recommendations cover both pleasure and commercial vehicles unless otherwise noted.

Model of	'08	'09	'10	'11	'12
Abbott Det.			A‡	A‡	A‡
A B C (air)		B*	B*	B*	
A B C (wat.)		A†	A†	A†	
Acorn			A	A	A
Adams&Farwell	B*	B*	B†	B*	B*
Alco	§	§	§	§	
Allen Kling		A†	A†		
American	..	A†	A‡	A‡	A‡
Am. Eagle	..		A‡	A‡	A‡
Am. La F.	..		A	A	A
Amplex		B*	B*	B*	B*
Ann Arbor	..				B*
Apperson	...	E	A‡	§	§
Atlas	.....	A	E	E	A
Atlas Com.	..		E	E	§
Atterbury (2)				A	
Atterbury (4)			A‡	A‡	A‡
Auburn (2)	..	A	A	A	E
Auburn (4)	..		A‡	A†	A
Austin	.....	A	A‡	A‡	A‡
Autocar (2)	.	B*	A‡	A‡	A‡
Autocar Com.		A‡	A‡	A‡	A‡
Autocar (4)	.	A†	A†	A†	A‡
Avery	.....		A†	A†	A
Babcock	...		A	§	§
BabcockCom.					A
Badger	.....		E	E	
Barker	.....				A
Barre	.....		A‡		
Belden	.....		E	E	
Benz	.....	A	A	A	A
Bergdoll	....		A‡	A‡	§
Berkshire	..A†		A	§	§
Best	.....				B*
Beyster Det.	..		A	A	
Black Crow	..		A‡	A‡	
Blair	.....				A‡
Boyd	.....				§
Brodesser	...		A	A‡	A
Brooks	.....				B
Brush	.....	A	A†	A†	A†
Buick (2)	....	A	A	A	A
Buick (4)	....	A‡	A‡	§	A‡
Burns	.....	B†	B	B*	B*

Model of	'08	'09	'10	'11	'12
Cadillac (1)	..	A†	B*		
Cadillac (4)	..	A†	§	§	§
Cameron	....	B†	B†	B	B*
CameronCom.	..				B‡
Carhartt	....			A†	A†
Carlson	.....		A‡	A‡	
Cartercar	...	A†	A	A†	A†
Cart'carCom.	B*	A	A†	A‡	A‡
Case	.....			A	A‡
Cass	.....			A‡	A‡
C. G. V.	.....	A†	A‡	A‡	
Chadwick	..	A	A	B*	A‡
Chalmers	...	§	§	A‡	§
Champion	..			A‡	A
Charron	....			A	A
Chase	.....	B	B	B	E
Cino	.....		A‡	A‡	A
Cino Com'l.	..		A‡	A‡	
Clark	.....		A	A	A
Clark Chicago			A	A‡	A†
Clark Lans'g			A	A	A
Clem. Bayard.	E	E	A	A	A
Club Car.	....			A‡	
Colburn	....		A	A	
Colby	.....			§	§
Cole	.....		§	A‡	§
Coleman	....			B	E
Columbia	...	A†	A†	E	A
Columbia Kt.					A
Commer	..			A	A
Commerce	..				E
Commercial.	.				A
Continental.	..	A	A	§	§
Corbin (air).	.	B†	B†	B†	
Corbin (wat.)	.	A†	A†	A‡	A‡
Corbitt	.....				A†
Correja	.....	A†	A†	A‡	A‡
Cortland (air)				B*	B*
Cortland(wat.)				A‡	
C. P. T.	.....	A	A		
Couple Gear.	A	A	A	A	A‡
Crane&Breed					§
Crawford	...	B*	B*	A†	A†
Crox.-Keeton			A‡	A‡	§
Crown	.....	B	A	A	

Model of	'08	'09	'10	'11	'12
Cunningham.			A	A	
Curtiss	.....			A	
Cutting	.....	A‡	A‡	A‡	
Daimler	....	A†	A†	A†	A
DaimlerK'ght			A	A	
Dain	.....			A	
Darracq	....	A†	A†	A†	§
Dart	.....				A
Davis	.....			§	§
Deal	... .		A	§	
Decatur	.....			A	A‡
De Dion	....	B*	B*	B†	B*
Delahaye	...	A	A	A	A
Del. Believ.	..	B*	B*	B*	B*
Dennistón	..			A‡	A
De Tamble.	..		A‡	A‡	A‡
Det. Dearb'n			A†	A†	
Diamond	...	A†	A	A	A
Dispatch	...				E
D. O. E.	.....				A‡
Dorris	.....	A†	A†	A†	§

Model of	'08	'09	'10	'11	'12
Duryea	.....	D*	B*	B	A
Dynamic	....			A†	A†
Eclipse	.....				A‡
Economy	...			A	A
Elmore	.....	A	A	§	§
E. M. F.	.....		§	§	§
Empire	.. ..			A‡	A‡
Enger	.....	B	B	A†	A†
Etmyre	.....			A‡	E
Everitt	.....		A‡	A†	A†
Ewing	.....		§	§	§
F. A. L.	.....			§	§
Falcar	.....			A†	A‡
Federal	.....	B*	E	A	§
Fiat	.....	A†	B*	A	B*
FirestoneCol.			A‡	A‡	A‡
Flanders	....		E	E	§
Ford	.....	A†	E	A‡	E
Fort Wayne.				A	§
Franklin	....	B†	B†	B‡	A‡
Frank. Com'l	B†	B*	B*	B*	A‡

Model of	'08	'09	'10	'11	'12
FrayerMiller.	B†	B†	§	§	
Frontenac	..	A	A	A‡	§
Fuller	.....	A	A†	A†	A‡
Fuller Com'l.					A
Gaggenau	...			A	A
Garford	....	A†	A†	A†	§
Garf'dCom'l.				A‡	§
G. J. G.	.....		A‡		§
Gleason	....		A†	A	
Glide	.....	A†	A	A‡	A‡
Gramm	.....			A‡	A‡
Gramm-Logan		A‡	A‡		
Grabowsky	..	A	B*	A	§
GreatSmith.	.	A†	A‡	A‡	A‡
Gt. Western.	.		B	A	§
Grout	.....	A	A	A	A‡
Halladay	...	A†	A†	A†	§
HartKraft(2)		A	A	A	
HartKraft(4)				A‡	§
Harrison	...				§
Hatfield	....	B*	§	B‡	A

Model of	'08	'09	'10	'11	'12
Havers	.....			A‡	A‡
Haynes	.....	A†	A	A†	A‡
Henry	.....			A‡	A
Herreshoff.	..	A	§	A‡	A‡
Hewitt (2)	..	A	A	A‡	
Hewitt (4)	..	A	A†	A‡	E
Hotchkiss	..	A†	A†	A	A†
Hudson	.....		§	A‡	A‡
Hupmobile.	..		§	§	§
Ideal	.....		A	A	A
Imperial	....		A†	§	§
Indiana	.....				A
International.	B*	B*	B*	B	B*
Interstate	..	A†	A†	A‡	A‡
Isotta	.....	A†	A	A	A
Itala	.....		A	A	A
Jackson (2)	.	A	A	A	
Jackson (4)	.	A†	A‡	A‡	A‡
Jeffrey	.....				A‡
Jenkins	.....	A	A†	A†	E
Johnson	....		A†	A†	A‡

* Use Gargoyle Mobiloil A in winter

† Use Gargoyle Mobiloil E in winter

‡ Use Gargoyle Mobiloil Arctic in winter

§ Use Gargoyle Mobiloil Arctic

Before anything like correct lubrication can be determined, these and other important considerations must be known and studied.

IN planning for a complete range of automobile lubricants, we first analyzed the construction of every domestic car and practically every foreign make.

Altogether we found that they required five distinct grades of lubricating oil. We then produced the oils.

So far as it was practicable, we filtered out the free carbon.

We verified the fitness of these oils by frictional horse-power tests on many cars they were intended for.

All the oils were put through practical demonstrations on their respective cars.

The test-results called for some changes, which we made.

Our ultimate findings are shown in the list at the bottom of this page. You will see scheduled there the correct oil for your car.

Some cars change type from season to season. The list gives the oil required for each season's type.

In selecting from this list you may rely on three things:

First: In quality, the oils establish a world-standard.

Second: The grade indicated for each make and each season was arrived at, not by guess, but by careful study. It was later verified by thorough demonstrations.

Third: *We recommend for your use the oil scheduled opposite your car.*

In engineering circles that would carry more weight than anything we have said above.

Old, badly-worn cars sometimes need a heavier oil than the same cars require when new. If your car is in that state, we shall be glad to recommend the oil for it. In writing, give the make of the car, the date o the model, the approximate mileage to date, and, so far as you can, its general condition.

The quality of Gargoyle Mobiloil necessitates a price that is somewhat higher than that of the usual automobile lubricating oils.

However, their use should result in an actual saving. Properly used they will go further than less correct oils.

Gargoyle Mobiloils are supplied to owners through garages, auto-supply stores and others who handle lubricants.

If the retailer who generally supplies you carries no stock at present, you should have no difficulty in securing through him the grade of Gargoyle Mobiloil you require.

The various grades go by the following names:

Gargoyle Mobiloil "A."
Gargoyle Mobiloil "B."
Gargoyle Mobiloil "D."
Gargoyle Mobiloil "E."
Gargoyle Mobiloil "Arctic."

They are put up in barrels, half barrels, in 5 and 1 gallon cans. All are marked with our Gargoyle trademark.

GARGOYLE

Mobiloil

VACUUM OIL COMPANY, Rochester, U. S. A.

FOREIGN MARKETERS

Vacuum Oil Company BOMBAY · Vacuum Oil Company, R. T. BUDAPEST · Vacuum Oil Company BUENOS AIRES · Vacuum Oil Company CAIRO · Vacuum Oil Co. of South Africa, Ltd. CAPE TOWN
Vacuum Oil Company COPENHAGEN · Vacuum Oil Company, S.A.I. GENOA · Deutsche Vacuum Oil Company HAMBURG · Vacuum Oil Company HELSINGFORS · Vacuum Oil Company HONG KONG
Vacuum Oil Company KOBE · Vacuum Oil Company LISBON · Vacuum Oil Company, Ltd. LONDON · Vacuum Oil Company Prop., Ltd. MELBOURNE
Russian Vacuum Oil Company, Ltd. MOSCOW · Vacuum Oil Company, S. A. F. PARIS · Vacuum Oil Company SHANGHAI · Vacuum Oil Company, A. B. STOCKHOLM

DISTRIBUTING WAREHOUSES IN THE PRINCIPAL CITIES OF THE WORLD

Model of	'08	'09	'10	'11	'12
JohnsonCom.				§	A‡
Jonz	E	B‡	A‡	A‡	
Kato			A‡	A†	
Kearns			A	B*	B*A
Kearns Com'l				A‡	A
Kelly				§	§
Kenmore				B*	B*A
Kline				A	A†
Kissel-Kar	A†	A†	A†	A‡	A‡
Kis.-KarCom.				§	§
Kline Kar				§	§
Knox	B†	B*	B*	B*	B*
Koehler				A‡	§
Koehler Com.					B*
Krit			A	A	A
Lambert	A†	A	A‡	A‡	A‡
LambertCom.	A		A†	A†	
Lancia	B*	B*	B*	B‡	B‡
Lauth Juerg's			A†	A	A
Leader			A‡	A‡	
Lexington			A	A‡	A†
Lincoln		B	B		§
Lion			E	E	A‡
Little Four				A‡	
Locomobile	A†	§	§	§	§
Lorraine				A†	
Lozier	A	A	§	§	§
Luverne	A	A	A‡	A†	
McFarland			A†	§	A‡
McIntyre(air)		B†		B*	A‡
McIntyre(wat.)		A‡	A‡		
Mack	A	A†	A†	A†	E
Mais				§	§
Marathon		A‡	B	A	A‡
Marion	A	A†	A†	A†	A‡
Marmon	B†	§	A†	A‡	§
Mason	A	A	A	A	A
Martin (2)			A	A	
Martin (4)				§	A
Marquette				A†	
(For '08, '09, '10 & '11, see Welch & Welch Det.)					
Matheson	A†	§	§	A	A‡
Maxwell (2)	E	E	E	E	E
Maxwell (4)	E	E	§	§	
Meiselbach	B*	B*	B*		
Mercedes	A†	A†	A†	A†	A†
Merc. Kght				A	A
Mercer			A‡	A‡	A‡
Mercury				B	B*
Meteor	A	A†	A†		
Metz	B‡	B‡	B‡	A‡	
Michigan			§	A‡	A‡
Middleby	B	B	A†		
Midland	A†	A†	§	§	
Minerva Kgt.			A	A	
Mitchell	A	A	§	A‡	A‡
Moeller			E	A	
Moline	A	§	A†	A‡	A‡
Monarch	B*	A†	A†		
Monitor			A‡	A	A
Moon	A†	A†	A†	§	§
Morgan	A	A	A	A	A
Mors	A	A	A‡	A‡	
Morse			A†	A‡	A‡
Napier	A	A	A	A	A
Natco					A†
National	A†	A‡	A	A	A
Norwalk			A	A	
Oakland		A†	A†	A‡	A‡
Ohio			A‡	A†	A†
Oldsmobile	A†	A†	A†	A‡	A‡
Oliver			A	A	
Opel			A	A	
Otto		A‡	A‡	§	
Overland	A†	A†	A†	§	§
Packard	E	§	§	§	§
Paige Detroit			E	A‡	A†
Palmer Sing'r	A	A†	A	A	
Panhard	A†	A†	A†	A†	A‡
PanhardKgt.			A	A	
Parry		A†	A†	A†	
Paterson		A‡	A‡	A‡	§
Peerless	§	§	§	§	§
Penn				§	§
Pennsylvania	A†	A†	A†	A	
Petrel		A†	A†	A‡	A‡
Pickard	A†	A†	B*	A	
Pierce Arrow	A†	A‡	§	A‡	A‡
PierceACom.				§	§
Pilot			A†	A†	
PittsburghSix	E	E	E		
Plymouth	A†	A†	A†	A‡	A
Pope Hartf'd	A†	A†	§	§	§
PrattElkhart		A†	§	§	
Premier	A†	A‡	A‡	A‡	A‡
Progress				A‡	
Pullman	A†	A†	A†	§	§
Rambler	A†	A	A	A‡	§
Randolph		A	A	A	A
Ranier	A†	A	A‡	A‡	
Rapid	A	A	A	A‡	§
Rassell			A	A†	
R. C. H.					§
Regal	A†	A†	A†	A‡	A‡
Reliance	A	A†	A†	§	A‡
Remington				A‡	
Renault	A†	A‡	A‡	A‡	A‡
Reo	A	A	A†	A‡	A‡
Republic				§	§
Rider Lewis.	A	A	A†	A†	
Roader				§	§
Rogers				B*	B*
Rolls Royce.	A†	A	A	A	A
Roy. Tourist.	A†	A†	§	§	§
Sampson (2)			A	A	
Sampson (4)	A‡	A‡	A‡	A‡	
Sandusky				A†	
Saurer		A‡	A‡	A‡	A‡
Sayers Scov.	B†	B†	B†	A‡	A‡
Schacht (2).	A	A	A		
Schacht (4).			A	§	
Schleicher			A†	A†	
Sears			B*	B*	
Seitz			A‡	A	
Selden	A†	A†	A†	A†	§
S. G. V.			B‡	B‡	
Simplex	A†	§	§	§	§
Simplicity	A		A†	A	
Smith		A†	A†	-	A†
Spaulding				A‡	
Speedwell	A‡	§	A‡	A‡	
Spoerers		A†	A†	A†	
Stafford			A†		
Standard Six.	A		E		
StanleySt'm.	D	D	D	D	D
Staver	E	A	A	A	A
Stearns	A†	A	§	A‡	A‡
StearnsKght.				A	
Stegeman			A‡	A	
Sterling		§	§	§	
Sternberg	A†	A†	A†	A	§
Stev.Duryea.	A†	§	§	§	§
Stoddard	E	§	A‡		
Stod.Dayton.	E	§	A	A	
Stod.Day.Kt.				A	
Studebaker	A†	A†	E	A‡	
Stutz					§
Stuyvesant			A‡	§	
Suburban			A†	A†	
Sultan	A†	A†	A†	A†	
Thomas	A†	E	E	E	A†
Transit				A‡	
Union				A†	
UnitedStates.			A	A	
Universal				§	
Utility			A‡	A‡	
Van Dyke		A	A	A	
Veerac			B	B	
Velie	A†	A†	A‡	A‡	
Victor	A	A	A‡	A‡	
Walter	A†	A†	A†	§	§
Ward				A	
Warren Det.		§	A	A	
Welch	A†	A†	A†		
Welch Det.			A†		
Westcott		A‡	A‡	A‡	
W. P. S.		A†	§	§	
White		§	§	§	
White SteamD	D	D	D	D	D
Whiting		A†	A†		
Wilcox		A†	A‡	E	
Willett				E	
Winton	A†	E	§	§	§
Zimmerman.	B*	B*	B*	A	
Zust	A	A	A	A	

* *Use Gargoyle Mobiloil A in winter* † *Use Gargoyle Mobiloil E in winter* ‡ *Use Gargoyle Mobiloil Arctic in winter* § *Use Gargoyle Mobiloil Arctic*

Notes and Queries

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12632) D. W. asks for an algebraic solution of the problem "An Arithmetical Nut." published on page 174 of the SCIENTIFIC AMERICAN.

The following is such a solution: Let us denote each man's share in the morning by F. Then after dividing at night, the fifth man must have left $5F$ nuts.

If E was the fifth man's share when he divided, then there must have been $(5E + 1)$ nuts when he started dividing, and he must have left $4E$ nuts after dividing; but these are also the $5F$ nuts referred to above. Hence,

$$4E = 5F$$

$$E = \frac{5}{4}F$$

If D was the fourth man's share when he divided, then there must have been $(5D + 1)$ nuts when he started dividing, and he must have left $4D$ nuts after dividing; but these are also the $(5E + 1)$ nuts referred to above. Hence,

$$4D = 5E + 1$$

$$D = \frac{5}{4}E + \frac{1}{4}$$

$$= \frac{25}{16}F + \frac{1}{4}$$

If C was the third man's share when he divided, then there must have been $(5C + 1)$ nuts when he started dividing, and he must have left $4C$ nuts after dividing; but these are also the $(5B + 1)$ nuts referred to above. Hence,

$$4C = 5D + 1$$

$$C = \frac{5}{4}D + \frac{1}{4}$$

$$= \frac{125}{64}F + \frac{5}{16} + \frac{1}{4}$$

Continuing this argument, we obtain

$$4B = 5C + 1$$

$$B = \frac{5}{4}C + \frac{1}{4}$$

$$= \frac{625}{256}F + \frac{25}{64} + \frac{5}{16} + \frac{1}{4}$$

and finally,

$$4A = 5B + 1$$

$$A = \frac{5}{4}B = \frac{1}{4}$$

$$= \frac{3125}{1024}F + \frac{125}{256} + \frac{25}{64} + \frac{5}{16} + \frac{1}{4}$$

$$A = \frac{3125}{1024}F + \frac{369}{256}$$

$$\text{or } A = 3\frac{53}{1024}F + 1\frac{452}{1024} \qquad (a)$$

Equation (a) gives us one relation between two unknown quantities A and F. This is not enough to completely determine A and F, but on the contrary allows of an infinite number of solutions. We may, however, further limit the problem of seeking the smallest integral values of A and F which satisfy equation (a).

One way to do this would be to plot the curve representing equation (a) and to note where this curve passes through a corner of a square, the paper being cross-ruled at unit distances.

If a purely analytical solution of the problem is insisted on, we can proceed as follows:

From equation (a) it is evident that, in order to make A a whole number, F also being a whole number, $\frac{53}{1024}F$ must be made equal to one or other of the following series of numbers:

$$\frac{572}{1024} \quad 1\frac{572}{1024} \quad 2\frac{572}{1024} \text{ etc.;}$$

any of which, together with the term $1\frac{452}{1024}$ in equation (a) sums up to a whole number. (We can leave out of account the factor 3 of the first term, since it will always give a whole number when multiplied by the whole number F.)

If we express the numbers of the series above as improper fractions with a common denominator 1024, we obtain for numerators the series of numbers shown in column I of the appended table:

I	II	I	II
572	0	6716	6144
1596	1024	7740	7168
2620	2048	8764	8192
3644	3072	9788	9216
4668	4096	10812	10240
5692	5120	etc.	

We must, then, look for the smallest number in this series which is a multiple of 53. It will be found that 10812 is that number, being 204×53.

Hence $F = 204$. The values of A, B, C, D, E can now be found without difficulty. There is no need to carry this out in detail, as the reader will readily be able to do this for himself.

The method given above may be slightly modified. We may write down multiples of 1024, as in column II of the table, and look for the smallest number which, on division by 53, leaves a remainder 11. This is found to be 10240. Add to this 572, and we obtain 10812, which is 204×53. As before, $F = 204$. This method has the advantage that the multiples of 1024 can easily be written down at sight. The *rationale* may be left to the reader to discover.

(12633) P. asks: Can you give me information upon recent experiments in the culture of plants by electricity? A. You will find an account of one set of experiments in the SCIENTIFIC AMERICAN, volume 106, No. 3, page 63, which we will send for ten cents. Another set of experiments have since come under our notice, upon flowers and vegetables. Here an alternating current was used, raised to a voltage of about 250,000. The start was from a lighting circuit of 110 volts at 60 cycles. A frequency changer raised the frequency to 600 cycles, from which the current passed into the transformer. In the experiment upon flowers the pots were set in a bed in a greenhouse. One conductor was run in the earth along the sides of the pots. This consisted of a heavy galvanized wire. A network of wires was run about 3½ feet above the plants. This was formed of six parallel wires upon insulators, with cross wires one foot apart. From these wires light chains 1½ feet long were hung at intervals down toward the plants. The current was turned on for six hours or more each day. It is claimed that fungi disappeared very soon from the bed treated electrically, although they were plentiful elsewhere, that the stems of the plants treated were unusually long and strong, the flowers unusually large, and that the side of the bed away from the light developed as good plants as that toward the light. Other experiments upon seeds and upon plants out of doors gave equally good results. If these reports can be relied upon, there is an encouraging field for further experiments.

(12634) W. B. asks: My mother has often taken frozen potatoes and put them into boiling water, and they were fairly good, at least. My wife recently tried the same thing, and they seemed fairly good, but at the next attempt they were utterly uneatable. She declares the water was boiling, though I cannot verify that, for I did not see it that time. However, I must admit that I don't see what difference that should make, anyway. A neighbor woman says they should be put, not into boiling water, but into cold water, "to take the frost out." Can you settle the questions raised, and give reasons? A. We have no information as to cooking frozen potatoes. 2. Why do people put frozen hands into cold water or snow, and likewise rub snow on a frozen nose or ear? A. We have from childhood been familiar with the belief that frozen ears, fingers, toes, etc., should be thawed by holding them in snow. In this way they are thawed very slowly, and the blood is not drawn to the injured parts to gorge them and make them painful, as is the case when the frost is taken out and the member is heated rapidly up to the blood heat. The case is entirely different in warming parts which are simply cold. They may be placed in warm water or held before a fire with little discomfort, but even then if the hands or feet are very cold, almost frozen, there will be painful burning when they are warmed too rapidly. We were very familiar with these things in northern New England when a boy. It seems to us that it is a matter of keeping the frozen part cool, so that it shall not have the blood forced into it and distend the vessels which have been injured by the frost. 3. I have often seen the statement that the blood is always at the same temperature, regardless of external conditions. Some of the blood may be, but certainly there must be quite a considerable amount near the surface that is far below this; when a person has undressed in a cold room. Yet I have seen the statement that you can judge the temperature of a baby's bath by the hand, "because the hand is always very near to 98 degrees." Does not that statement need a good deal of modification? A. The blood of a person in health is always at 98.40 deg. Fahr. If a person is in a cold place, his body does the best it can to keep the temperature up to that point. If exercising, we are generally able to do this, and feel a warm glow for that reason. When we do not produce enough heat to replace what we lose by radiation into the cold space about us, we grow cold ourselves and are soon overcome. A young healthy baby will have its hands of normal temperature, and its hand can be used as you say to test the warmth of its bath in a rough way; but a thermometer is far better. So too in undressing in a cold room, the body in health maintains its temperature against the cold of the room, although the skin probably becomes colder than the flesh under it. We do not try to adapt ourselves to the temperatures of our surroundings. We are heat producers, trying to keep ourselves hotter than our surroundings.

NEW BOOKS, ETC.

HALF-HOURS WITH THE SUMMER STARS. By Mary Proctor. Chicago: A. C. McClurg & Co., 1911. 16mo.; 232 pp.; illustrated.

THE GROWTH OF A PLANET. By Edwin Sharpe Crew, M.A. New York: The Macmillan Company, 1911. 8vo.; 351 pp.; illustrated. Price, $2 net.

THE HEAVENS AND THEIR STORY. By Annie S. D. Maunder and E. Walter Maunder. Boston: Dana Estes & Co. 8vo.; 357 pp.; illustrated. Price, $2 net.

STAR LORE OF ALL AGES. A Collection of Myths, Legends, and Facts Concerning the Constellations of the Northern Hemisphere. By William Tyler Olcott. New York: G. P. Putnam's Sons, 1911. 8vo.; 453 pp.; 160 illustrations.

These four books, differing widely in scope and treatment, all deal with the firmamental glories which science and poesy join in reverencing and praising. Mary Proctor takes us to the dim, mysterious dome of the Yerkes Observatory and there, through the giant tube and its 40-inch object glass, she gives us glimpses of the glittering, constellations of the night, and particularly of that galaxy known as the Milky Way. Legend and poetry are unsparingly drawn upon to impress the reader with the splendors revealed. We cannot read her descriptions and assimilate the knowledge her ready pen imparts without feeling a greater awe for the star-peopled spaces of our vast universe and for the secrets they keep so well. In "The Growth of a Planet" Edwin Sharpe Crew presents the different theories by which astronomers seek to explain the formation and growth of worlds, and attempts to reconcile these theories, so far as possible, one with another. His aim is interpretation rather than criticism, and he has not allowed the necessity for condensation to cloud his meaning or to diminish to any extent the interest and value of the work. "The Heavens and their Story" is a commendable attempt to awaken in the general reader a desire for systematic study of the heavens. The author shows that even without the aid of telescopes and observatories man may learn to read the symbols of the night to his own joy and profit. The main divisions deal with the stories told by the heavenly movements, the stories told by the sun, the stories told by the sun's family, and the stories told by the stars and nebulæ. There are beautiful plates in color showing spectrums, the corona, and eruptive and quiescent prominences. "Star Lore of All Ages," Mr. Olcott's offering, is a sumptuous treasure-house in which the lover of ancient myth and modern miracle may wander for enchanted hours. Its red and gold doors open upon a gallery of masterpieces in art, all being inspired conceptions connected in some way with star lore. The pictures and the legends of all ages have been ransacked to make this gallery irresistible to art and nature lovers, and not in vain. Withal, the most intense facts of astronomical knowledge and discovery are given beside the tapestried romance which earlier peoples wove with star-stuff as the medium of their art. It is a book delightful to the eye, scholarly in conception and treatment, and charming to the inner sense.

SEARCHLIGHTS ON SOME AMERICAN INDUSTRIES. By James Cooke Mills. Chicago: A. C. McClurg & Co., 1911. 8vo.; 299 pp.; with illustrations and photographs from drawings. Price, $1.50 net.

The title might lead one to expect a critical survey of monopolistic conditions. This is far from being the fact. The author takes exception to the assumption that history should consist mainly of wars and intrigues, and believes that thrift and industry should predominate in the record. He has therefore studied the conditions and results attending the production and marketing of such staples as lumber, salt, sugar, paper, rubber, and leather, and graphically describes the history, environment, and processes of these various necessaries. The life of the lumber-jack, the methods for wood-pulp and fibre, and the adventuring after crude rubber, all come within the range of his searchlight and are picked out with a fidelity to detail and at the same time a recognition of their most appealing features that makes the reader a very willing spectator of the panorama as it unfolds to his gaze.

ABROAD IN A RUNABOUT. By A. J. and F. H. Hand. Chicago: A. C. McClurg & Co., 1911. 12mo.; 356 pp.; illustrated. Price, $1.50 net.

Since Mark Twain took his Innocents abroad, a constant stream of books has issued for the benefit of innocents on foot, innocents on bicycles, and, finally, innocents in automobiles. Only one unfrequented path remains to be beaconed for us—that of the "air lane." In "Abroad in a Runabout" we have text and illustrations far above the average, the former conveying humor, atmosphere, and helpful suggestion, the latter instinct with the picturesque values of old-world scenery. The route of the car—which, according to our authors seems to have been a two-cylinder runabout with a four-cylinder motor!—embraces all the better-known places of France, Germany, and Switzerland. In adopting this independent mode of travel, Mr. and Mrs. Hand seem to have had a happy inspiration. They were enabled to pick their own roads, to hurry through uninteresting country, to stop when and where they pleased, and still, with all comfort, to keep their expenses down to $575 from Havre to Havre, or $1,550 from Chicago to Chicago. Those who can afford this very reasonable outlay for a summer's outing would do well to read the story of how the authors managed it.